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Use of Manufactured City Gas for Making Glass

By M. R. Scott*

In 1912 the Bausch and Lomb Optical Company, of Rochester, New York, started a glass plant with the idea of making enough optical and ophthalmic glass to fill their own needs and thus render them independent of Europe. The development was rather slow until the beginning of the war in 1917 when the plant was enlarged to almost its present size and turned over entirely to making optical glass for government use.

After the war the demand for optical glass decreased to such an extent that it became necessary to again start working on ophthalmic glasses in order to carry the plant and organization along. This time, using the valuable experience gained in making optical glass, the development was

A SCENE IN THE BAUSCH & LOMB PLANT—RETURNING EMPTY POT TO FURNACE AFTER CASTING

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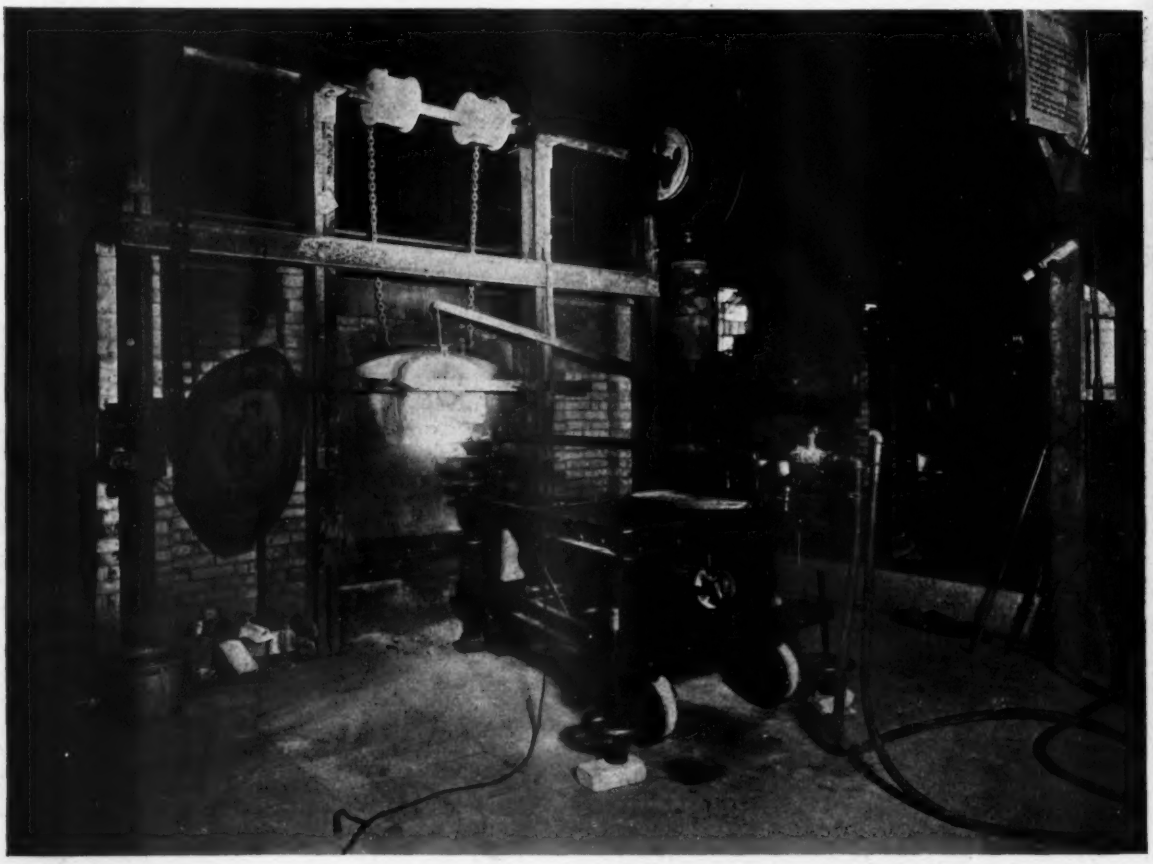
started on a much larger scale and made to include not only the clear colorless eyeglass but the various combinations used for fused bifocals, colored glasses, goggle glasses, etc. These glasses, which are now the main output of the plant, are also usually classed as optical because of the high precision required for their use but their optical properties are such as to put them in a general class known as ophthalmic glasses.

Equipment

For use in melting glass we have available three single pot furnaces each large enough to hold one 36 inch diameter pot, three double pot furnaces large enough to hold four 30-inch diameter or two 36-inch diameter pots, and one sixteen pot furnace built for pots about 30 inches in diameter. Also sixteen pot arches for heating up pots.



GLASS MELTING FURNACE AT OPERATING TEMPERATURE, SHOWING STIRRING MACHINE AND WATER-COOLED ROD IN POSITION

Fuel

The entire plant is equipped for using manufactured city gas which is supplied by the Gas and Electric Corporation of Rochester. Our plant is adjacent to one of the gas plants owned by this utility company and we are supplied with gas through two 8-inch service pipes direct from the outlet of the gas works holders. This close connection enables us to use the gas at the pressure which the holder maintains without the usual loss due to long distance transmission. This gas is a mixture of coal gas and carburetted water gas in the proportion of approximately 60 per cent coal gas to 40 per cent of the water gas. The coal gas is made by the distilling of high grade soft coal in retorts, thereby driving off the gaseous products in the coal and leaving behind in the retort the well known product, coke. The carburetted water gas is made by passing steam through a hot fuel bed either coke or hard coal and then spraying oil into this hydrogen gas in order to give it the required heating value. Both of these gases are then put through a series of processes which remove the tars, oils and sulphur and when ready for distribution, are put into the gas holder and intimately mixed.

The heating value of this gas remains very constant and is tested every hour and a report made to the State Public Service Commission each month of the daily average heating value of the gas sent out. The pressure is supplied at from 6 inches to 8 inches of water pressure and changes only when there occurs an unusually severe load on the gas system.

The following is a typical analysis of the mixed gas which has a net value of 537 B.t.u.'s per cubic foot with a specific gravity of .57.

Gas	Per Cent
CO_2	2.3
Illuminants	5.5
O_2	1.6
CO	20.4
H_2	39.6
CH_4	20.1
N_2	10.5
	100.0

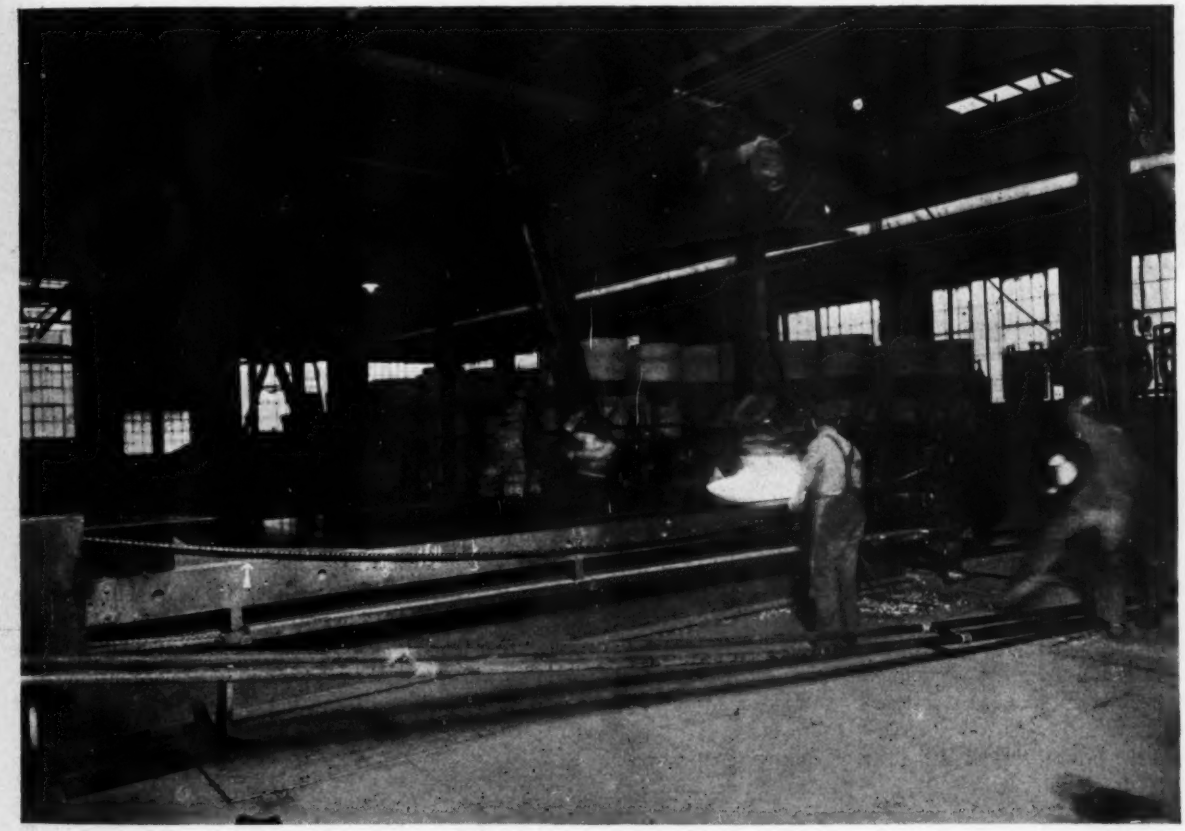
Operation Data

The melting furnaces are all of the regenerative type and the air and gas are reversed every twenty minutes. They are rectangular in shape with the burners on the sides and tuille or doors on the ends as shown in the pictures. The checkers are built below the floor level and the flues are connected to the usual type of stack.

The temperature is controlled by means of a Leeds & Northrup optical pyrometer, the readings being taken on the rear wall of the furnace until the cooling period and then on the surface of the glass. Also in order to keep a check on the temperature changes between optical readings, platinum thermo-couples are installed in the crown of each furnace and connected to a Leeds & Northrup multiple point potentiometer recorder which records each furnace every six minutes.

As stated above, the main output of the plant is either the clear or colored ophthalmic glass which is usually an ordinary soda-lime glass having an index of refraction of 1.5230 at the D line and a specific gravity of approximately 2.52. This glass is melted in open pots at about 2,600° F. and after the melting is completed, it is stirred by machine with a clay tube on the end of a water cooled rod. The same general plan of handling is followed as that which has been so often and fully described for making optical glass. The entire process of making this glass takes one complete day or 24 hours which includes heating up the furnace, filling in the batch, melting, fining, cooling and casting the glass.

The average amount of gas consumed in making a complete melt of ophthalmic glass in a four pot furnace is 110,000 cubic feet. If this glass is cast into sheets 3/8 inch thick, the total gross weight of glass will be about 1,800 pounds which means that it takes between 61 and 62 cubic feet of gas to make one pound of glass. The amount of gas burned during the melting period, say two to three hours after the first fill is about 5,000 cubic feet per hour. The following flue gas analysis will give a fair idea of the efficiency of combustion obtained. This is an average of four samples taken at different times during the melt.



POURING A POT OF OPHTHALMIC GLASS ONTO THE CASTING TABLE WHERE IT IS ROLLED INTO A SHEET

	Per Cent
CO_2	9.0
O_2	8.9
CO	0.0

The temperature of the secondary or preheated air is about 1,565 degrees F. (This reading was taken by placing a thermocouple in the chamber over the checker brick and below the burners and is an average figure for the melt.)

General Considerations

The question of changing to some other type of fuel has been considered on several occasions since this plant has been in operation. From the standpoint of combustion, it has been proven that the city gas, although of a relatively low B.t.u. value per cubic foot is able to hold its place in comparison with other fuels especially at glass melting temperatures, due to its high efficiency of combustion. When all the factors are thoroughly studied and the economies considered, it

is always found that for our situation, the manufactured city gas is without doubt the best and most economical fuel to use.

Our plant, besides being a relatively small one, has a type of production that varies widely from time to time, which means that if we had our own gas production apparatus, it would be necessary to invest large sums of money in equipment for use at only certain periods. The overhead charges on such equipment, which would necessarily be idle when production was low, would be excessive. Also as all of our glass is used for high precision work it is necessary for us to produce of optical quality continuously. This means that we must have a regular supply of good, clean, uniform gas from day to day.

Advantages

1. The gas comes to us in an excellent condition and it is not necessary to clean it. It is suitable for melting glass in open pots and annealing without the use of muffles.

2. We are always assured of a good supply of clean gas regardless of what our production rate is.

3. It is not necessary for us to invest money in gas producing or storage equipment and the difficulties of fuel supply as well as the handling and storage of raw fuel are eliminated.

4. It is important to keep the dust and smoke nuisance away from a plant working on high grade optical instruments.

5. The furnace temperature can be controlled within fairly narrow limits.

6. The Rochester Gas & Electric Corporation maintains a staff of competent engineers who are always ready to assist us with our combustion problems without charge.

Acknowledgment

We wish to acknowledge the assistance of Leo J. Sullivan of the Rochester Gas and Electric Corporation in the preparation of data for this article.

Greater Tank Output Without Temperature Increase

Suggestions to Increase the Production of Continuous Tanks by Stirring the Semi-Melted Batch to Hasten Melting

By a Well Known Glass Technologist

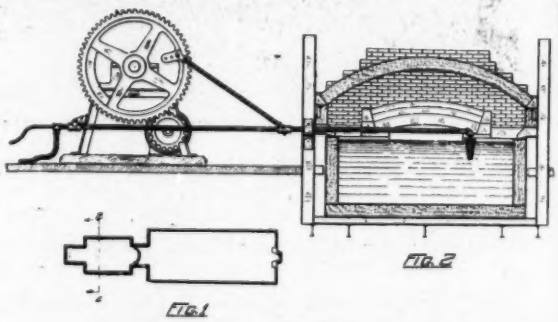
The past ten years have seen a change in the technique of tank operation in the United States. At the beginning of this period it was the custom to carry tanks at temperatures of 2250-2350° F. and to regulate the amount of glass "pulled" by the quantity of ware needed. Little attention was paid to seeds and stones, for anything that would hold water would sell. It is noteworthy that the tanks lasted from 20 months to three and four years when operated in this way.

At the present time it is the custom to carry temperatures of 2550-2650° F. and to melt only the amount of glass that can be made free from seeds and stones. Obviously the yield per tank per week has increased greatly and at the same time the quality of the glass has improved. The color is better and the increased temperature has helped to eliminate two of the glass maker's bugbears, seeds and scum. Under these conditions the tank life has materially shortened; in some cases it being as brief as six and seven weeks.

Naturally such a short tank life is highly unprofitable to the glass maker and every effort has been made to promote the production of quality glass by other means than boosting the tank temperature. Among these might be mentioned the use of more uniform raw materials both as to chemical composition and to size. Also the better mixing of the batch materials and the use and thorough mixing with the batch of uniform size, homogeneous cullet.

It is the purpose of this article to draw attention to a method for extending the principle of thorough mixing. We all know that optical glass is stirred during its manufacture. The reason for this is to promote homogeneity of the metal and to get rid of cords or striae. Geo. W. Morey[1] states that the melting time of optical glass was cut in half by stirring during the fill. This was to eliminate the bubbles, mix the glass with the melting batch and hasten the melting.

When batch melts, the melting is from the top downward



W. F. BROWN STIRRING DEVICE

and the fluxes tend to melt first, leaving a highly siliceous glass on the surface. This high silica glass is more viscous than the underlying layers and offers a greater resistance to the escape of seeds.

If we could stir the glass continuously in the region near the dog-house we would be doing the following things:

1. We would break up the batch piles into smaller and smaller units. The surface of the batch exposed to the heat would increase with each stroke of the stirrer and eventually

[1] "An Improved Method of Opt. Glass Manufacture." *Jour. Am. Cer. Soc.*, Feb., 1919.

each particle of raw material would be surrounded with molten glass and be subject to dissolving action on all sides.

2. We would rid the glass of seeds and diminish the amount of dissolved gas. It is much quicker to free any liquid from bubbles by stirring it than to let it free itself by standing.

3. The high-silica glass on the surface would be mixed with the glass from lower levels and consequently there would be less chance for scum to form and for cords to persist.

4. There is a strong possibility that the tank could be run at a lower temperature and give the same yield of quality glass. This would be beneficial to the tank blocks, tanks would last longer and the fuel cost would be lowered.

5. The effect of a stirrer would be to hold back the large batch piles and to break them up into innumerable small piles all over the back end of the tank.

There is no good reason why stirrers should not be used in a tank. Both mechanical and hand stirrers have been used for many years in making optical glass in pots.

In Vol. 3 (1922), No. 6, page 122 of THE GLASS INDUSTRY a patent to W. F. Brown is abstracted and a device for stirring glass in a continuous tank furnace is described.

Quoting from the article:

> "In a furnace of the above mentioned type, the mixed batch and cullet is fed in at one end of the tank, where it is melted by exposure to intense heat, and slowly flows back through suitable refining and cooling chambers, till it is of the proper temperature and consistency for delivery to the sheet-drawing or other article forming machine as the case may be. Now certain elements of the batch, such as the alkalies, have a lower fusing point than other components, such as lime and silica, and if the temperature of the furnace should fall somewhat below normal, the components will melt unequally and the flow of molten glass will become streaked and of uneven composition. These streaks, or flow lines, if left undisturbed, may follow through the entire furnace and be drawn into the sheet produced from the molten glass, causing striae or 'lines' in the sheet, which injure the quality of the finished product.
>
> "It is the purpose of the apparatus about to be described, in connection with the accompanying drawings, to break up these flow lines, and blend and interfuse the uneven striae in the molten glass, so as to furnish an even and homogeneous flow of glass to the drawing point. A stirring finger or thimble of porcelain or pot clay is carried on a downwardly projecting stirring rod, secured by a suitable elbow to the end of a horizontal supporting rod, which extends through an aperture in one side wall of the furnace. The rods are watercooled to prevent their destruction by the furnace heat, being preferably formed of inner and outer pipe sections, the water flowing in from a hose connection through an inner pipe, thence back through the outer pipes, and through a flexible connection to the sewer. The finger, when in working position, projects downwardly into the slowly flowing stream of molten glass and by means of the supporting rod, the finger may be reciprocated back and forth through the flowing glass, thus breaking up and dispersing the lines of uneven composition in the glass stream and improving the quality of the product."

It would appear from this, that Mr. Brown's idea was that the stirrer be placed well forward in the tank. It seems more probable that this would be beneficial if it were placed in the back end near the dog-house so that the batch piles could be broken up and the melting itself facilitated.

It would (see figure) be better if the finger extended downward half of the depth of the glass and if the water-cooled support rod were to extend clear through the tank and be supported on both ends.

New Method of Melting Tank Glass

On May 16, 1923, a very important paper was read before the British Society of Glass Technology by Alexander Ferguson, describing innovations of a revolutionary character in glass manufacturing practices. The scheme laid before the Society, involving a complete redesign of the whole factory from the beginning of the producer plant to the end of the lehr, included a new melting furnace which embodies changes of a far reaching nature in glass melting furnace design and operation. In a recent meeting of the Society the chairman, Thomas C. Moorshead, general manager of the United Glass Bottle Manufacturers, Ltd., announced that a furnace, designed on the Ferguson principle has been built and is being tried out at the Charlton plant of this concern.

Mr. Moorshead, who was formerly chief engineer with the Illinois Glass Company at Alton, Illinois, is largely responsible for the marked development of the United Glass Bottle Manufacturers, Ltd., since the close of the war. It was due to his progressive spirit that new production methods were established, including the installation of the most modern American automatic machinery and labor saving devices, substitution of oil for coal, and mass production systems. Credit is due to his initiative which has enabled the inventor to test his ideas on a manufacturing scale.

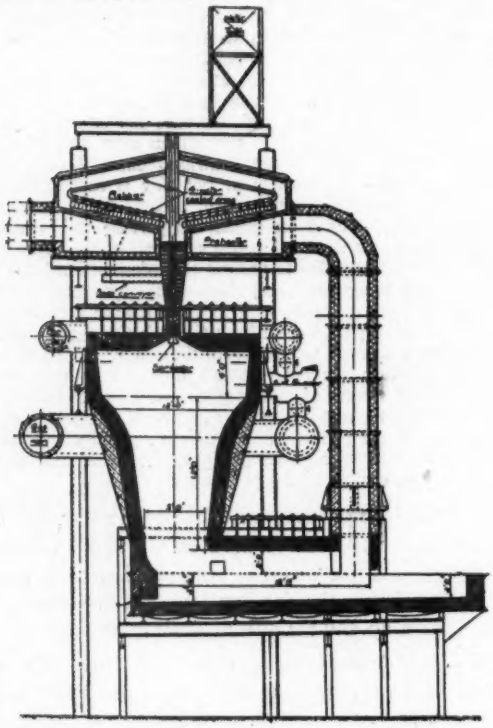
The new method is based on allowing the reaction between the batch ingredients to occur while in a state of suspension in the hot combustion gases. This is obtained by reducing the batch to a finely powdered condition, about 60 mesh, and by whirling it around while exposed to the flame in a combustion chamber of special design. In this way the reaction becomes practically instantaneous, in contrast with the slow reaction occurring in the dense, viscous, half molten glass in the glass melting tank.

The melting chamber of the furnace is funnel shaped. The greatest diameter is about 12 feet. The smallest 5 feet. The sides of the furnace are slightly curved. The batch, preheated, is delivered at the top of the furnace by a screw conveyor. It is distributed by a mechanical spreader revolving at a speed of from 160-220 revolutions per minute into the vortex of a whirling cone of hot gases at the rate of 2 pounds of batch per second. The flame velocity in this part of the furnace is about 175 feet per second. The drops of glass resulting from the reaction of the raw materials are thrown against the walls of the furnace by the force of the whirling gases and are caught in the receiving chamber located below the combustion chamber.

The waste gases pass seven times around the furnace and are then led over the molten glass in the receiving chamber from where they escape to the stack.

In the plans as proposed originally by the inventor there

was made provision for preheating the batch with the waste gases. In the experimental plant the batch is preheated by means of auxiliary burners.



To eliminate smoke in the flame, the coal is retorted at low temperatures. The heat expended for this purpose will be utilized in the lehrs. The producer gas, made from the resulting coke is enriched by the inclusion of the methane, ethane and ethylene obtained by retorting the coal.

The burners resemble oil burners, and by having a central high pressure hot air delivery into the center of the flame, any unburnt carbon is consumed.

The inventor claims that the new process will melt and refine six tons of glass with one ton of coal. This saving in fuel is made possible by the speed of melting due to intimate contact of the minute batch particles with each other and with the flame gases. The radiation from this furnace is claimed to be only about two per cent of the total heat applied, which means that about 1.3 tons of coal will be lost by radiation per 75 tons of glass.

The following is a comparison, in a condensed form, of usual practice and the new method, taking coal at 7,400,000 kilo. calories per ton, or 7,300 cals. per kilo.:—

Old Method K. Calories.		New Method K. Calories
2,397,600,000 =	324 tons heat supplied *v.* 162 tons =	1,198,800,000
Dr. temp. 1800°C.	Work done..... Temp. 1800°C. Dr.	
221,583,600	Melting batch.....	75,438,000
265,322,240	Chemical heat Cr. 32,358,400.....	.....
63,328,000	Latent heat	54,880,000
64,600,000	Radiation above glass level.....	1,913,587
749,952,000	Maintaining and refining.....	12,096,300
64,600,000	Radiation below glass level.....	2,709,404
1,429,385,840	All above should be got over 1350°.....	147,037,291
	14/24ths of 1800°C.T have been used in old style, ∴ 210° out of 360° of cycle, and so temp. is only 750° *v.* 14/120ths used ⅛th new style ∴ temp. still 1575°C.T.	
968,214,160	Balance at 750° to regenerator.	
2,397,600,000	Radiation up-flue and outside preheater....	7,392,600
	Preheating and transfer through iron.....	151,898,400
As above.	Radiation down-flue and recuperator.....	353,575,400
	Preheating to 450° air, coal, sand, lime....	208,224,000
	∴ Coal = 117.3 tons.....	868,127,691
	Chemical heat *Cr*.....	= 32,358,400
		835,769,291
	= 4.4 tons + 23 from CO_2 = 27.4 ton	
	Net used tons 89.9	
	Balance of 162 tons unused.....	*363,030,709
	As above.....	1,198,800,000
		As above

* = 72.1 tons coal.

Life of Leather Belting

By W. F. SCHAPHORST

In a recent number of a prominent publication, a writer makes much ado about a belt installed in a certain plant, that had seen seventy-five years of continuous service and was still good for more. The belt, he claimed, had never been dressed with a belt dressing. The claim is made in the article that leather belts were built better in "the old days" than today.

We can see no reason why a leather belt in a glass factory power plant, box-making shop, or elsewhere should not last 75 years or 100 years on a given drive where conditions are favorable to long life, as apparently was the case in this plant.

Where belt speeds are low, where the belt is ample in width, protected against sunshine and fumes, where the pulleys are sufficiently large in diameter and if the belt does not have the tendency to pound itself to pieces as is the case on so many high speed machines where pulleys are small—then long life may be expected. We know of belts that are 40 years old and that are still pulling full loads apparently just as well as they did on the day they were installed. We also know of a belt that has been installed for over 40 years—a beautiful slack belt—the remarkable thing about it being that it has never been shortened. As the superintendent has said about the belt: "It has never had a knife put to it." That is one of the advantages of a nice slack belt—the slack side automatically takes care of the shortening problem. The slack side, of course, approaches the tight side as the stretch increases, but it so happens that in this drive ample belt proportions were used and when that is the case the stretch is practically negligible because the unit stretch is so small. In fact in all of the long life installations known to the writer the belts are good, wide, well proportioned belts. The designers were not stingy in giving the belts plenty of width and thickness.

However, simply because a belt will last 75 or 100 years without dressing is no reason why it should not be dressed, because there is no question but that when properly dressed with the right kind of dressing the belt will do better work, and it should be even longer lived than when not dressed, in the same way that shoes last longer if kept shined.

Glass Division Votes on Sand Specifications

The members of the Glass Division of the American Ceramic Society have received ballot forms from the chairman, Prof. Alexander Silverman, for a vote of approval or disapproval on the question of adopting the tentative specifications for silica sand for glass-making which were prepared by the Division's Committee on Standards in cooperation with the Bureau of Standards at Washington.

In 1923 these specifications were submitted to members for discussion and suggestions for amendments were invited. Following is the text of the specifications:

General

1. **Character of Sand.**—Sand as commonly used for glass-making purposes is a white, clean, dry, fine-grained quartz, washed practically free from all clay-like material and other impurities. The chief criterion for a good glass sand is that it should be practically all silica and contain very little iron. In view of the increasing use of alumina in a glass batch and of the varying amounts of iron allowable in green or amber glass, sand of lower grade may be used by many manufacturers. These specifications, therefore, will show a variety of qualities and state more or less definitely the types of glass they may be used for. The quality number is not to be interpreted as necessarily being an index to value of the product.

Requirements

2. **Packing.**—Cars in which sand is to be shipped shall be thoroughly cleaned before loading, and lined with paper where sand is sold for first, second or third quality.

3. **Impurities.**—Sand shall not be contaminated with stripping dirt or contain any crushed stones or pebbles. These impurities are often insoluble in the melting glass, producing stones.

4. **Screening and Washing.**—All sand shall be screened, washed and dried before shipment, except where the natural condition of the quarries will allow the production by screening only of fourth, fifth, sixth or seventh quality sand.

TABLE I

PERCENTAGE COMPOSITION OF SANDS OF VARIOUS QUALITIES (BASED ON IGNITED SAMPLES)

Qualities	SiO_2 Max.	Min	Al_2O_3 Max.	Min	Fe_2O_3 Max.	Min	CaO+MgO Max.	Min.
First quality optical glass	99.8		0.1		.02		0.1	
Second quality flint glass containers tableware	98.5		0.5		.035		0.2	
Third quality flint glass	95.0		4.0		.035		0.5	
Fourth quality sheet glass rolled and polished plate	98.5		0.5		.06		0.5	
Fifth quality sheet glass rolled and polished plate	95.0		4.0		.06		0.5	
Sixth quality green glass containers and window glass	98.0		0.5		0.3		0.5	
Seventh quality green glass	95.0		4.0		0.3		0.5	
Eighth quality amber glass containers	98.0		0.5		1.0		0.5	
Ninth quality amber	95.0		4.0		1.0		0.5	

5. Although sand may vary considerably in composition, depending on the type of glass to be made, the composition of any single quality specified shall not vary from shipment to shipment more than the amounts stated in Table II.

TABLE II

PERCENTAGE TOLERANCES IN COMPOSITION ALLOWED (BASED ON IGNITED SAMPLE)

Quality	SiO_2	Al_2O_3	Fe_2O_3	CaO+MgO Rmx
1	±0.1%	±.05%	+0.005%	±0.05%
2	±0.5	±0.1	+0.005	±0.05
3	±1.0	±0.5	+0.005	±0.1
4	±0.5	±0.1	+0.005	±0.1
5	±1.0	±0.5	+0.005	±0.1
6	±1.0	±0.5	±0.05	±0.1
7	±1.0	±0.5	±0.05	±0.1
8	±1.0	±0.5	±0.1	±0.1
9	±1.0	±0.5	±0.1	±0.1

6. Sand shall be prepared so that the size of grains shall be rather uniform and be within the limits set in Table III:

TABLE III

LIMITING PER CENTS OF VARIOUS SIZES OF SAND GRAINS

Through a No. 20 screen	100%
Through a No. 20 and remaining on a No. 40 screen	Not more than 60% nor less than 40%
Through a No. 40 and remaining on a No. 60 screen	Not more than 40% nor less than 30 %
Through a No. 60 and remaining on a No. 100 screen	Not more than 20% nor less than 10%
Through a No. 100 screen	Not more than 5%

Methods of Testing

Screen tests shall be made with sand dried to 110°C, using United States Bureau of Standards standard screen sizes.

Methods of Analysis

To determine silica, lime and alumina, follow methods given in Hillebrand's Rock Analysis, U. S. G. S., Bulletin No. 700.

Iron may be determined by any of the following methods:

Colorimetric Method of Iron with Sulphocyanate.

Scott's Standard Methods of Chemical Analysis (*Bull.* 3 (1907), page 222).

Electrometric Titration.

Stokes & Cain Method (Bureau of Standards).

The following method may be used for solution of the sands for any method of determining iron:

.5 gm. sample. Fuse in Pt crucible with four times wt. of pure Na_2CO_3. Dissolve in 200 cc. warm H_2O (warm on steam bath). Dilute 15 cc. of conc. HCl to 50 cc. Add this from a burette slowly, drop by drop to the solution, stirring frequently and keeping solution cold to prevent silica from separating out. The acid having been added, add a small amount of pure Zn (.05 gm.) to solution to precipitate out any Pt dissolved in the carbonate fusion. When Zn has dissolved, filter the solution into a 500-cc. graduated flask and proceed.

A BIBLIOGRAPHY OF BIBLIOGRAPHIES ON CHEMISTRY AND CHEMICAL TECHNOLOGY, 1900-1924, by Clarence J. West and D. D. Berolzeimer, is announced by the National Research Council, Washington, D. C., as their Bulletin No. 50 (308 p., $2.50). This work is composed of the following sections: General Bibliographies, Abstract Journals and Year-Books, General Indexes of Serials, Bibliographies of Special Subjects and Personal Bibliographies. As the title indicates, the work is a compilation of bibliographies published as separates, or at the end of books or magazine articles, or as footnotes to the same, on the numerous aspects of pure and applied chemistry. Each entry gives name of author or compiler, title, and place of publication. The majority of the entries state the number of references, thus giving an indication of the completeness of the particular bibliography. The entries are classified under the proper subject-headings, alphabetically arranged. The duplication of individual entries has been largely avoided by the liberal use of cross-references. An approximate analysis shows that there are about 2,400 subject headings, 7,500 author entries and a total of 10,000 individual bibliographies. Although no claim is made for the completeness of the compilation, it is believed that the work will furnish a convenient starting point for any bibliographic search.

Making 265,000 Electric Light Bulbs Daily

How a Large Manufacturer Solved the Annealing Problem—Modern Furnace with Automatic Temperature Control Reduces Losses and Increases Production

By F. A. Becker*

That gas should be used in the electrical industry is somewhat of an anomaly but such is the case in electric light bulb manufacture where the glass bulbs are heat treated or annealed to remove strains induced while blowing them. That the quality of this glass is directly proportional to the heat treatment it receives is generally recognized and the problem of accomplishing this result has been solved at the Newark Bulb Works of the General Electric Company to the entire satisfaction of all. This plant is one of the largest of its kind in the world. Here they turn out on the average of 65,000 Christmas tree lamp bulbs, 80,000 small flash light bulbs, 40,000 side and rear automobile light bulbs, 15,000 radio bulbs, and 65,000 headlight bulbs every working day.

Originally improvised ovens were used in which heat was generated by open gas flames with all the attendant nuisances and fuel waste, besides a loss of many bulbs through improper temperature control. The Surface Combustion Company of New York installed two small furnaces for us some three years ago in which city gas was used, and these gave such universal satisfaction that we recently purchased one of their larger sizes through which our entire output is passed daily and we have never yet taxed it to capacity. This new installation has excited much interest and representatives from many companies manufacturing articles from glass have visited our plant for the purpose of examining this furnace and were most favorably impressed with its operation.

The furnace is about 16 feet long and is divided into three zones, pre-heating, heating and cooling, the first being 5 feet 9 inches long, the second 3½ feet, and the third 7½ feet in length. The hearth accommodates pans 11½ inches wide, two rows, and is high enough to take them in stacks of four, some 18 inches. The pans are pushed through the ovens by means of hydraulic jacks. The method of heating is unique and was developed by the Surface Combustion Company after many years of experimentation and research, and includes two systems, high and low pressure. In both systems a theoretically perfect mixture of air and gas is obtained and automatically maintained in the nozzle so that complete combustion is attained upon ejection. The temperature regulation is through a single valve, the exact proportions of air and gas being retained regardless of the manipulation of this valve.

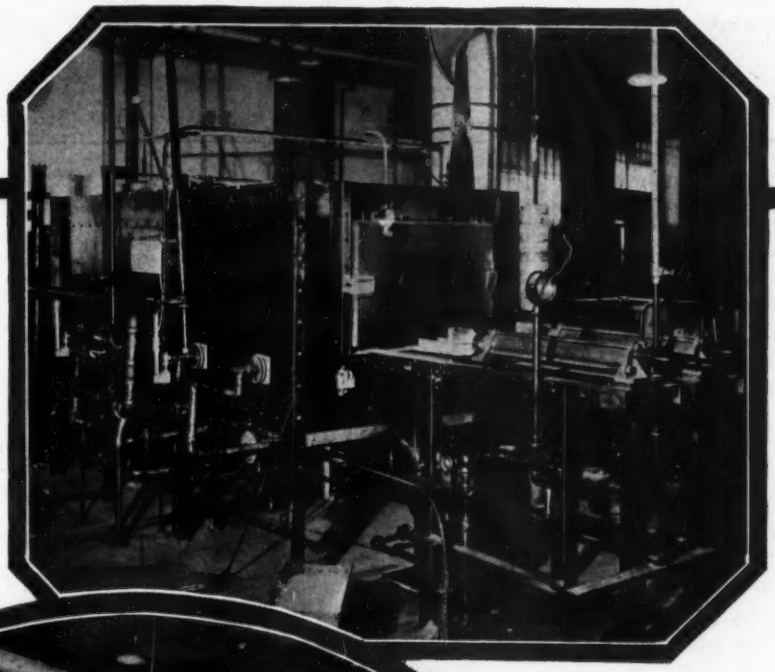
In the high pressure system a small compressor boosts city gas from line pressure to 10 pounds, which passes through an inspirator where it sucks in the exact amount of air required. The low pressure system consists of a small pressure blower which raises air to one or two pounds pressure and this air is passed through an inspirator where it takes up city gas at zero pressure, the ratio of gas to air being automatically controlled by a governor. The latter system is used in the installation at our plant. The highest degree of combustion and burner efficiency yet developed is obtained through this exact proportioning of air and gas and also from the method of combustion where the flame is played upon porous refractory material which is brought up to incandescence and which promotes both heat combustion and heat radiation, thereby generating a great deal more heat with the same gas consumption.

Another feature of the furnace installed at our plant is an automatic control whereby any temperature desired is automatically maintained. This is a Wilson-Maeulen potentiometer controller, unit type, with automatic electric cold junction compensation, motor driven. This control is so sensitive that annealing can be done with almost mathematical precision. This is a very desirable feature and the quality of glass turned out is at once apparent. In the old improvised ovens, where the temperature fluctuated, many batches came through without the proper amount of annealing and many bulbs were lost through fracture when ends were cut off, and many more went the same way when heat was applied for sealing. As labor is the least and material the largest item of cost in the manufacture of bulbs we consider this reduction in breakage to a minimum, an accomplishment of which we are proud.

The electric light and radio bulbs are made entirely from glass tubing which is inserted in vertical upright machines each holding 12 rods. Each of these glass tubes, which are about 4 feet in length, has a rubber tube stretched over its top and air is forced in at 16 inches water pressure. The bottoms of the tubes are then inserted in moulds and heated to melting temperature by small gas jets. As they are melted, the air blows them out to bulb shape. The machine then automatically rotates them to a cutter where the bulb is automatically cut off and the tube dropped down a notch ready for another bulb to be made from it. When cut off the bulbs drop onto a mechanical conveyor which takes them to an inspector who looks them over for defects and then puts them in pans ready for the annealing furnace. In the furnace the Christmas tree bulbs are subjected to a temperature of 450 degrees Centigrade for 20 minutes while the flash light bulbs are held in a temperature of 500 degrees Centigrade for half an hour.

The low fuel consumption of this furnace is perhaps one of its greatest attainments and we were more than surprised when we ran our tests and found that it consumed gas in the amount of only 31 cents an hour. The capacity of this oven is 48 pans an hour, and as each pan will hold about 2,000 bulbs, this means 96,000 bulbs an hour or more than 800,000 in an 8½ hour day. This far and away exceeds our entire production.

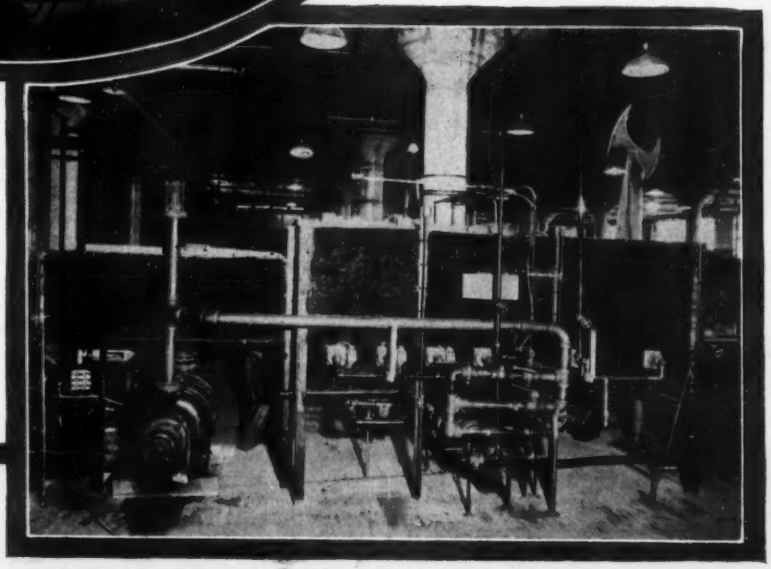
* Manager, Newark Bulb Works, General Electric Company, Newark, N. J.



End view of gas heated glass annealing furnace at Newark Bulb Works of General Electric Company, showing hydraulic rams for pushing work through.

Automatic machines which blow from glass tubes placed in an upright position, scores of millions of bulbs used annually for Christmas tree lamps, radio sets, flash lights, and automobile side, rear and headlights.

The ends of the glass tubes are heated by gas jets, blown to bulb shape and cut off, all by mechanical means.



Side view of furnace. This one furnace anneals the entire output of electric lamp and radio bulbs at the Newark, New Jersey, plant.

The Laboratory

Notes on Glass Lusters

Coincident with the increasing demand for colored glassware there has again grown up an interest in glass showing the characteristic surface iridescence known as luster. This effect is obtained by the decomposition by heat of certain organic metallic compounds which are reduced to metallic oxides or to the metallic state, and are made to adhere firmly to the glass surfaces to which they have been applied. The metals used to produce lusters are applied in the form of metallic resinates.

Resins are a class of uncrystallizable vegetable products, insoluble in water as distinct from gums. They are found as natural or induced exudations from trees. These compounds soften upon heating, are soluble in alcohol, ether, benzene and most vegetable oils.

Common rosin or colophony is a resin obtained by the distillation of turpentine oil from crude turpentine. This substance has the property of combining with alkalies, forming a product closely akin to soap, known as resin soap. This is made by boiling ordinary colophony with a solution of sodium carbonate. The acid radical of the colophony replaces the carbon dioxide from its combination with sodium oxide, thus forming resin soap. The boiling is continued until all of the resin has been saponified.

Saponification can be speeded up by boiling the resin with a mixture containing 10 per cent sodium hydroxide and 90 per cent sodium carbonate. The hydroxide emulsifies the resin which facilitates the saponification process.

The resin soap is much more soluble in hot water than in cold. For this reason it is advisable to pour the hot, concentrated solution of resin soap into a large volume of water. This should yield a clear, light-brown colored solution of resin soap.

While the resinates of the alkalies are water soluble, the resinates of most other metals are insoluble in water and can therefore be prepared by adding metallic salt solutions to solutions of resin soap. On mixing these liquids, insoluble metallic resinates are formed giving precipitates that can be separated by settling, decantation and filtration.

The resinates must then be dried. This is done by allowing them to dry on the filter paper in an air bath heated to about 35 to 40 degrees C. Higher temperatures should be avoided since heat may impair the solubility of the metallic resinates in vegetable oils.

When the drying is completed the resinates are to be dissolved without delay. The solvents used are rectified oil of turpentine, lavender oil or oil of rosemary.

The oils should be fresh and colorless. To test the oil, a thin layer is spread over a piece of glass and is allowed to evaporate. If a brown residue is left, it is an indication that the oil contains resin, which on burning is apt to leave brown, discolored spots.

The metallic resinates most commonly used are those of iron, copper, silver, lead and bismuth. Less common in the glass industry are the resinates of nickel, cobalt, chromium and manganese.

The metallic salts selected for the preparation of lusters are always those that are freely soluble in water. For the preparation of silver resinate, silver nitrate is used, for lead resinate a solution of lead acetate is made, for copper resinate, copper sulphate is taken. Lusters of iron, nickel, cobalt, chrome and manganese are made with the chlorides of these metals.

Bismuth resinate is made by the dry process, that is, by melting resin with basic bismuth nitrate. To obtain this salt, metallic bismuth is dissolved in nitric acid and the solution poured into a large quantity of water. The bismuth is precipitated in the form of basic bismuth nitrate, which settles on the bottom of the container as a white powder. This is washed and dried.

To prepare bismuth resinate one part of the bismuth salt is mixed with four parts of resin. The mixture is carefully heated with frequent stirring until a homogeneous compound is obtained. This is dried, pulverized and dissolved in oil of lavender.

According to the effects desired the metallic resinates are applied either singly or in combination. The application with a brush requires considerable skill which can only be obtained by long experience.

Some Recipes for Lusters[1]

Iron luster, reddish brown:

1 part of Iron resinate,
1 part of Lead resinate,
2 parts of Lavender oil.

Cobalt luster, grey:

1 part of Cobalt resinate,
1 part of Lead resinate,
2 parts of Lavender oil.

Uranium luster, yellow:

4 parts of Uranium resinate,
5 parts of Lavender oil.

The glassware is painted with the lustering solutions and is allowed to dry. It is then transferred to a kiln and fired carefully. The resinates are destroyed by heat and the metals or metallic oxides remain on the glass surface. They are allowed to fuse partly into the glass surface until they adhere firmly. The reduction of the oxides to metals is done by heating in an atmosphere of carbon monoxide.

The preparation of lusters is a very difficult matter and the majority of glassmakers prefer to buy their supplies from concerns specializing in the production of glass chemicals whose experience enables them to obtain the best results.

[1] R. Hohlbaum. Zeitgemäsze Herstellung, Verarbeitung und Verzierung des feinen Hohlglases.

Final Sessions of Tariff Hearing on Plate Glass

BY means of its comprehensive reports covering the Tariff Investigation now under way, the GLASS INDUSTRY has put before its readers the specific details of existing conditions relating to tariff problems in the plate glass industry as disclosed by the examination of sworn witnesses—information which otherwise would have been practically unavailable in such detail to the majority of those interested in the industry, for the reason that no official report of the hearing has been or will be put into print for general distribution.

A CONDENSED report is given below of the testimony taken on the last day of the public hearings held at Washington on November 23, 24, 30 and December 1 in connection with the investigation being made by the United States Tariff Commission into the cost of producing plate glass in the United States and foreign countries.

This information was desired by the Commissioners for use in reaching a decision in the case of the Buckley-Newhall Company, of New York, and others who applied for a decrease in the duty on plate glass and mirror plate, under the law which permits the President under certain conditions to take such action.

Two sessions of the hearing were held on each of the four days during which it was open. The official typewritten report of the proceedings filled 776 pages with approximately 160,000 words.

The "Preliminary Statement" prepared by the Tariff Commission, containing about 14,000 words, was printed in full in the November, 1925, issue of the GLASS INDUSTRY before the hearing was opened, and abstracts giving the gist of the witnesses' testimony and containing in excess of 30,000 words (making a total of 33 pages) have been printed in the December, January, and this February issue.

H. B. Higgins, sales manager of the Pittsburgh Plate Glass Company, was the first witness to take the stand on December 4:

MR. MCCUMBER (appearing for Pittsburgh Plate Glass Company): Q. Will you describe briefly the differences in the method of manufacture between the old and new methods? A. There has been some little confusion in the use of the term continuous process. It is continuous in two respects,—the first with reference to the production of the glass, and the second with respect to the grinding and polishing.

In the old process, as has been thoroughly explained by other witnesses, the glass is passed from pots onto a table intermittently, one pot succeeding another. In the new process the glass is drawn from a tank in a continuous sheet by various methods, according to the plan followed by the different manufacturers. Then in the grinding and polishing the glass is laid on tables under the new process which move continuously under a series of machines. In the old process the glass is laid on circular tables which are moved about from one machine to another. Those are the essential differences.

When we talk about a continuous process we should be specific as to what that refers, whether the making of the glass itself or whether the grinding and polishing.

Q. You may state whether or not in your opinion the new system as operated by you has sufficiently progressed as to enable you to say how much, if anything, it will reduce the cost of production. A. Well, it is quite impossible to say what that new process will do. It has many very desirable features but it has many decided objections. Our operations fluctuate greatly. One month we will have a satisfactory operation and the next month a very poor operation, and the following month perhaps a good operation. So it is purely in the experimental stage and no one can possibly say what will come of this new process. It is absolutely pioneering work.

Chief Saving in New Process is Labor

Q. Can you inform this Commission to what extent you have investigated the cost of the different processes, including labor, that would enable you to give some view as to the saving in the cost of any of the plants? A. The statement was made by Mr. Solomon that the principal saving in this new process was labor. He said that two-thirds of the labor would be saved by the new process. Mr. Vaurie, if my memory serves me correctly, said the labor was about half, in the new process.

When I returned to Pittsburgh I asked our manufacturing department to give me a statement of the comparative labor employed in our new process at Creighton and at Ford City for the month of October. That statement shows that the number of hours of labor required to be performed on glass at the new Creighton plant was just six per cent less than at Ford City, where the old system is used.

Q. Can you tell from your investigation, or did you receive any information as to whether there was any decrease in the cost in any other line than that of labor? A. I did not ask for that. It is still too early to determine just where the savings are in this new process. We expect to make them. Eventually we feel confident that the difficulties which have been encountered so far will be overcome, but as to where the saving will be or how much it will be it is impossible to state.

Q. Do you know anything about the cost of constructing a plant in Belgium and in the United States so as to arrive at any comparative costs for such construction? A. I have no detailed figures as to that. Our own experience in building our plant in Courcelles several years ago after it was destroyed during the war indicated that the costs there were much less than in this country. And we all know, of course, and the Commission's statement of information shows, that labor costs abroad are far below the costs in this country.

Quantity Produced by New Process

Q. Can you give us any estimate of the percentage of plate manufactured under the new process which goes into the general consumption in this country? A. About 7 per cent. I mean that our Creighton plant is the only plant making glass by a continuous process, and that 7 per cent means that out of roughly 100,000,000 feet, excluding the Ford Motor Company, produced this year in the United States, we at Creighton have made, or will have made, about 7,000,000.

Q. The reason you did not include this other plant you speak of? A. The Libbey-Owens is not a continuous process except with reference to its rough glass. It is not continuous in grinding and polishing.

Q. Can you from your knowledge of the business give us any light upon the probable increase by the continuance for a year or two, of the amount that will probably be produced in the United States under the new process going into the market and that which will be produced by the old method? A. It will be somewhat larger next year, because we are duplicating our present Creighton plant. But as an offset to that there will be other new production by the old method. I should think it might be increased one or two per cent possibly next year.

COMMISSIONER COSTIGAN: Q. Are you speaking of your own business or of the United States as a whole? A. I am referring to our own business solely, because there are no other manufacturers who will have production by that method next year.

MR. MCCUMBER: Q. Can you give us an estimate by percentage of the difference in cost of production and the cost of erection of a plant at this time under the old process and what it cost in 1905 or 1907? A. Assuming from the Commission's statement of information here that the fixed assets shown on page 22 represent the book value of plant and equipment, that

figures out approximately 41 cents per square foot of annual production.

Q. Then, to replace those plants for manufacture under the new system would require a capital of about how much? A. Well, I am not quite ready to say, and I should much prefer not to say, what it costs to build a plant by this new system. But may I say parenthetically that a halo has been thrown about this new process by my friends on the left. They have made statements that conservatively can be described as wild imaginations. We feel more harm can result to us and to the plate glass industry as a whole, and possibly to many investors, by letting the statements go unanswered than could come to us if we give out some information regarding this process, which we would much rather keep to ourselves. So I am going to give you, and have already given you, some figures which I think will convince any reasonable and thoughtful man that these statements are inaccurate. Now, I hope you will be mindful of the fact that we are spending millions of dollars on what I said was pioneering work, upon experiments. And naturally if those experiments and this expenditure of money proves to be an advantage we want that advantage. There are many friends here on my right who would give a right arm to get a lot of information on this new process. There are also friends from Belgium, and a gentleman here from Pilkington Brothers, who would be delighted to have much information concerning what we are doing at Creighton. So the information I will give you about that process will be only sufficient to refute what has been said by the opposition. Continuing along this line, I will say that so far as cost of the plant is concerned, the fixed assets which are shown on page 22 figure out approximately 41 cents per square foot of annual production. No plant can be built by the new process for anything like 41 cents a square foot of annual production. I am willing to say that.

Relation of Cost of Production to Sales Price

COMMISSIONER GLASSIE: Q. What determines the relation, if there be any relation, between the cost of production and the sales price of the several grades? A. Nothing at all except the demand and the supply. You will find no uniformity whatsoever between the prices in different brackets or between different qualities. The price of large glass may move up and the price of small glass may move down. The price of glazing quality glass may move up and the price of some of the better qualities may either be stationary or move up in a greater or less proportion to the glazing quality.

Q. The cost of production has substantially no relation to those prices except in the vast aggregate that your returns must be equal to your expenditure and your capital? A. Except as to what we refer to as the average selling price. We have every month the average selling price of our glass. We will say that last month we made and shipped 5,000,000 feet of glass. Let us assume that we got for it $2,500,000. We had an average selling price of 50 cents per square foot. We had an average cost of so much, and the difference is our profit.

Q. Now, to translate that into terms of tariff. Does it follow from that that, in your view, the duty, if there be a duty on glass, shall be uniform? In other words, being a specific duty on glass of so much per square foot, that the rate of duty should be determined by the difference in cost of production of all glass as a mass? A. I can't see any other explanation to it.

Q. Then may we not have a duty on the smaller sizes of glass which is vastly more than the actual value of the glass? A. Why, yes. And that is not at all inconsistent with the theory of protection. For instance, to cite the case to which Mr. Solomon referred of glass selling for 18 cents a square foot where the duty and charges of getting the foreign glass would amount to 18 cents, which he described as absurd. Now, the factories must sell that glass, and if of our production costs, six or seven per cent falls in that category, it is sure that we have to sell it for that price in order to dispose of it. Now, if that glass, in accordance with the suggestion made by Mr. Solomon, were admitted free of duty, the burden of foreign supplies would be added to the burden of the supplies in this country and they would still further depress prices, so that instead of selling it for 18 cents we might be selling it for 12 or 10 and our average price would be correspondingly affected. Furthermore, I cannot possibly understand what interest the foreign manufacturers could have in so unprofitable a market as that, unless they too had precisely this same problem. Now, they have. And their own selling prices in other markets of the world will prove that conclusively. They want to participate in the market for small glass because they are perfectly willing to sell it for less than cost, just as we do. And I do not see that the Government need have any fear of too high a duty on plate glass that is sold for a third of the cost of production.

Believes Higgins Hit the Nail on the Head

Q. What you are saying, I think, goes right to the heart of the matter. Let us put out of view the matter of no duty, because this statute does not permit the transferring of anything to the free list, nor does it permit a reduction of anything more than 50 per cent; but taking the case as you put it, I would like to get your view as to this situation. If you have a flat duty determined by the difference in cost of production of all glass made in a foreign country and the cost of production of all glass made in the United States, and that duty applies to the small pieces which sell for the prices which you indicated, is it not quite conceivable that that duty would operate of necessity to exclude the importation of all small sizes, leaving, of course, the larger sizes to come in with the corresponding advantage, and wouldn't the difference between the foreign situation and your situation, for example, be this—I want to get your view now—that whereas you have an open market in the United States in which you may sell your small glass below cost and recoup upon the larger sizes, getting, as you say, an average return greater than your average cost, thus giving you a profit, the foreign producer by reason of the duty on the smaller sizes, which is just as much as on the larger sizes, may be absolutely prohibited or excluded from selling any small sizes in that market and thereby be relegated to the sale of the larger sizes exclusively? A. That is perfectly correct if you confine your reference to small glass to these sizes which sell at say 16 cents, 18 cents and 20 cents; and that is quite correct.

Q. But the reasoning which applies to the 18-cent glass must apply with slightly different force to the 20-cent glass? A. Yes.

Q. And 22-cent glass and 24-cent glass if there be any. A. Yes, sir.

Q. And may there readily be conceivably a point up to which any duty which would be no longer bracketed, any flat duty, might operate to cut out substantially all importations up to a given mathematical point in the scale, and by reason of it being flattened out for all glass production might conceivably at the other end reduce the tariff burden, if you may call it such, upon the importations, and perhaps stimulate the importation of the larger sizes? You cannot tell exactly how it will work out, but a flat duty must manifestly— A. There is no question about that, and it has always been true, even under the graduated duty. There have always been sizes that have always been excluded from abroad because they were sold at a lower price in this country than the foreigners could afford to sell them for and pay the duty. That has always been the case and always will be the case unless you remove the small glass entirely and put it on the free list. May I make this suggestion also, that if the cost of production is determined upon by sizes and it is proposed to make a reduction on these very small sizes to permit the foreign glass to come in, there should be a corresponding increase on large sizes to protect the American manufacturer for what he loses in his average selling price for the lower prices he will have to make on his small glass. That must inevitably follow if we are to have protection at all.

Foreign Glass Sales Below Cost

COMMISSIONER COSTIGAN: Q. Is it your judgment that the foreigners sell glass in the United States below cost of production? A. Yes, sir.

Q. Is he guilty of technically dumping in violation of the statute which deals with such sales? A. I think some of them have been and are today. I have some evidence which I will be glad to show you a little later.

COMMISSIONER GLASSIE: Q. Why do you describe it as dumping? A. Because they are selling in this country for less than at home.

COMMISSIONER GLASSIE: The Commission, of course, is interested in violations of the anti-dumping statute, if there be any.

MR. MCCUMBER: Q. Mr. Higgins, if the cost of production of a square foot of a certain grade of glass in Belgium is the same as the cost of production of a square foot or a hundred

square feet, then they are selling a great deal in this country for less than the cost of production? A. Yes, sir.

Pittsburgh Plate Glass Exports

Q. I show you exhibit 38 and ask you what it is. A. This exhibit is an analysis of the export sales of the Pittsburgh Plate Glass Company for the year 1924 and for the first nine months of the year 1925 according to bracket. Mr. Solomon made the statement that the average price received for glass exported was something like 27 cents, I think, and offered that as evidence of the willingness of the American manufacturer to go abroad and sell for much less than he sells at home. This average price is, of course, affected by the character of the export, and this statement shows that of our export—and the Pittsburgh Plate Glass Company does almost all the exporting. This statement shows that the exports for the year 1924 were about 70 per cent under one square foot. You can therefore get a picture of that size. And for the first nine months of 1925 about two-thirds of the glass was under one square foot.

THE CHAIRMAN: Q. Mr. Higgins, has there not been considerable confusion between value and cost? This investigation relates to the cost of production of this article. You have clearly demonstrated that the small sizes are of the same quality, made in the same manner, and up to a certain point it is not distinguishable in any way from the glass which has, because of its size, a high value but the same cost. As you go on with the process you add additional labor to the smaller size glass at additional expense. From a cost point of view the small size glass costs more to produce than the large size glass. The reason why there is a difference in value is because of the demand for glass. As you get smaller and smaller in size you enter a field where other types and kinds of glass compete with your plate glass. You could not take a sheet of window glass a hundred feet square and have it serve the purpose of the large size plate glass; it would not stand the strain; but as you get smaller and smaller in size you enter a field where ordinary window glass competes for purposes of utility, with your glass, and to sell it you have to meet the competition of that window glass? A. That is a perfectly correct statement of the fact.

MR. MCCUMBER: Q. Perhaps it has been sufficiently covered, Mr. Higgins, but as you have been in the glass business a great many years I would like to have you also state what constitutes plate glass or what peculiarity differentiates it from other glass. A. The ground and polished surfaces. It makes no difference by what process the glass is obtained before work is begun on it, the differentiating characteristic of plate glass is its polished plane surfaces, parallel surfaces that give a perfect reflection when seen in reflected light, or that give a perfect vision when looking through it at any angle. It is the ground and polished surface which gives glass the perfect vision and reflection.

Q. Is therefore the drawn glass which is used to make plate glass and which is ground and polished and converted into plate glass, of substantially the same quality and character as that which is cast and ground and polished? A. Absolutely the same.

Foreign Manufacturers' Prices

Q. You may examine Exhibit No. 39 and state what it is. A. This is a tabulation of prices showing the prices quoted by European manufacturers for delivery to the United States, for sale at home in Belgium and for sale in England. If studied you will see that in the different categories higher prices are charged by Belgian manufacturers at home than for sale in the United States, and it is particularly true of England. The prices in England are much higher than the prices the English manufacturers quote for delivery to this country. The table will show that.

Q. That is, the wholesale prices for delivery in Belgium of the Belgian article is greater than the wholesale prices of that which is to be imported into the United States? A. That is correct.

Q. And that is also true in the English market? A. Yes, sir.

Q. I offer in evidence Exhibit No. 40 and ask you what it is? A. This is a compilation of delivered prices at important cities in the United States, American prices and foreign prices; a comparison of the two price lists is rather difficult on account of the additions and subtractions that must be made, so I have this figured net because of the different brackets delivered at New York, San Francisco, Detroit, Chicago and various centers, from Europe and from the United States factories. All discounts are deducted, including cash, including freight allowances made by American and foreign manufacturers, and all freight and boxing charges are added. This is the net cost of the two products delivered at destination.

Q. Will you please explain some of the items in order that the Commission may fully understand the purport of the exhibit? A. The reason this is submitted in evidence is that there seemed to me to be some misunderstanding or confusion of testimony when it was stated that the cost of foreign glass delivered in this country was about the same as the cost of American glass. Mr. Solomon testified to that effect, and Mr. Solomon is not a manufacturer. He is, we will say, a jobber or importer, a man who handles the factory product and resells it. So there is some confusion in his testimony. Much of his testimony regarding prices referred to his own prices and not to the foreign manufacturer's prices at all. So if you are going to compare our prices with the foreign prices the testimony should relate not to the prices at which the foreign glass is re-sold but to the price at which it is sold to the original buyer in this country. The purpose of this exhibit therefore is to show the exact differences according to the manufacturers' price list in this country and the manufacturers' price lists abroad. There are various differences, ranging from two to five, and out on the Pacific Coast particularly, where we are at a great disadvantage, about ten cents a foot.

Mirror Plate and Mirrors

Q. Some evidence was given yesterday by Mr. Campau with reference to mirrors and mirror glass. Have you anything to say with respect to that evidence? A. The price at which this mirror was purchased seems to represent about twice the value of the glass. The size, I believe, was 28 by 38. And I think the exhibit was offered particularly to show the relative cost of a mirror as compared with the cost of making a given piece of furniture that carries that glass. The cost of that glass in the silver, according to the current market prices of the quality that is generally being used is about $9.35 and not $14.53, as was stated, I think. The first silver in quality is used in making that cost, and there is practically no first silvering quality being used in the Grand Rapids market. The Grand Rapids manufacturers particularly seem now to be making furniture to a price rather than quality, and they are not using anything like the second silvering or first silvering glass that they used to. This particular manufacturer may have used it. But the point I wish to bring out is that considering the furniture industry as a whole the cost of a mirror as shown in that exhibit is quite inaccurate.

Freight Allowances by Foreign Manufacturers

Q. I show you Exhibit No. 41, a memorandum showing the freight allowances made by the foreign manufacturers. A. The statement was made in previous testimony that when prices were quoted they were quoted net, and there was much confusion in that testimony because the gentleman speaking was again not a factory representative and was not referring to factory prices but to the re-sale prices. The purpose of this exhibit is to show the freight allowances that are made by the foreign manufacturer. You will find in the foreign price lists, I think, certain references to freight allowances. These allowances are not made on all sizes of glass. They are made on some sizes. But they show that the foreign manufacturer is not only able to pay the present duty but in addition to it he is perfectly willing to allow three and four cents a square foot extra.

Witness Reverts to the New Process

Q. Is there any other matter pertaining to this case on which you would like to express an opinion or give any evidence? A. Referring once more to this new process about which there has been so much discussion, and particularly to the statement by Mr. Solomon that there was a great saving in waste because in the old process the sheets were large and in the new process the sheets were relatively small, and secondly there was less waste. The shrinkage that one has in a factory depends not so much upon the size as upon the defects, and the new process has been, as Mr. Cruikshank indicated, susceptible to many, many difficulties regarding the quality of glass from the tanks. The glass itself from the tank is not itself so reliable as the glass from the furnace, and it is more defective, and consequently you have more waste because we must cut around those defects.

To give you some concrete and definite information, I checked our loss from cutting to the glass delivered into the warehouse for the month of October with the old process. And our loss cutting was 90 per cent more by the new process than by the old process for the month of October, which will perhaps give you some enlightenment on that subject.

There is an important point in connection with the investment which it is well to keep in mind, and that is that when you are manufacturing glass by the furnace method a spare capacity of about 20 per cent is required to provide for the rebuilding as the furnaces grow old and begin to cave in. When you are manufacturing by the tank method—and the tanks, by the way, will operate only about 9 months until they are put down and rebuilt practically—you must have a 100 per cent spare capacity. There is no way to avoid it. And that is a very important consideration in the item of investment.

A tank, and the lehr and buildings and miscellaneous equipment that go with it, will cost about a million dollars.

Another item in connection with this that I would like to mention is that we have discussed the Libbey-Owens process, and I have shown you that the Libbey-Owens Company makes glass by the continuous method but do not grind and polish by the continuous method. The Standard Plate Glass Company, as Mr. Troutman explained yesterday, makes glass by the furnace method, but have been experimenting for a number of years with the continuous grinding and polishing method. Evidently Libbey-Owens feel there is no particular advantage in the grinding and polishing, and evidently the Standard Plate Glass Company feel there is no particular advantage in the continuous method of producing. We do both. I mention these matters to corroborate what has been said. It is very much experimental, and many, many contradictory opinions exist.

The selling price of glass has a lot to do with the cost. If you are making something for 50 cents it does not seem much unless you know what you can get for what you make. Our experience with the new process has been that it is not comparable with the old, that the value of the product is much less than the value of the product by the old process.

For the entire year 90 per cent of the product from our Creighton factory has been shipped in sizes under five square feet. 98 per cent of it has been shipped in sizes under 10 square feet. That again clearly corroborates what has been said concerning the manufacture of glass, as to both breakage and quality. Our factory loss in the month of October was 100 per cent greater at Creighton than at Ford City.

Q. What do you mean by your factory loss there? A. We lay a certain amount of the rough glass, grind it and polish it, and finish a certain amount of glass which is passed to the warehouse. The factory loss is the difference between the number of feet laid and the number of feet received in the warehouse. That results from breakage.

Costs in Belgium

Q. Mr. Higgins, I would like to have you turn to the cost table on page 20 of the Commission's tentative findings and make any explanation you desire to make. A. The very ingenious method which the Commission's representatives devised for figuring the cost gave them a figure of 29.6 cents on approximately 20,000,000 feet of glass. Now, you will observe that a weighted average was found with this figure of 29.6 cents on 20,000,000 feet and a cost that was obtained at one other factory on actual production from book records. That was our plant. I don't know the exact figures that your representatives found, but that plant was probably producing about 5,000,000 feet of glass. So that this 20,000,000 feet at a price of 29.6 cents was weighted with a production of about 5,000,000 feet at a lower price, so that the weighted average determined was 28.6 cents. In other words, the actual book figures which the Commission's representatives found in our plant on 5,000,000 feet pulled down the cost on 20,000,000 feet a full cent.

So the actual cost and the only actual cost which your representatives found abroad was apparently about 25 cents. And it would seem perhaps an actual figure, even for one plant, and that a new plant that had not been in operation very long, was perhaps a more dependable guide than one determined by figures indefinite although, of course, the very best your agents could find. We have never felt, nor have we ever claimed, that the cost of production at our Belgian plant was any less than the cost of production for other Belgian plants.

Factory Capacities and Production

MR. MCKENNA (appearing for National Plate Glass Company, Edward Ford Plate Glass Company, and Standard Plate Glass Company): Q. Mr. Solomon during his direct examination made certain statements concerning the production in the United States under the new process or the continuous process at various plants. He spoke of plant capacity frequently as distinguished from plant production. He referred to the production at the Highland Park plant of Mr. [Henry] Ford as about three and a half million feet. Do you think his estimate is correct? A. No, sir. That will actually be less than 3,000,000 feet this year.

Q. How about the River Rouge plant which he stated to be 10,000,000 feet? A. That will be less than nine.

Q. And St. Paul he gave as approximately 10,000,000 square feet. A. That new plant of the Ford Motor Company at St. Paul is practically a duplicate of the plant at Highland Park, which, as I have said, this year [1925] will make less than 3,000,000 feet of glass.

Q. And on the Libbey-Owens plant he gave that as 15,000,000 square feet. What is your view concerning the production of Libbey-Owens under this so-called continuous process? A. The Libbey-Owens Company has been reticent about talking about their production and capacity. I don't know of anyone outside the company who has any reliable figures on it. Gossip that comes to us indicates that they will not make this year a million and a half feet. Perhaps that would be too high. I have never heard anyone refer to its total capacity as anything in excess of six or seven million feet, if it were operating perfectly, which it is not.

Q. Mr. Solomon stated on page 274 of the record that the Creighton plant had a capacity of 20,000,000 square feet while Mr. Cruikshank estimated yesterday about 10,000,000 square feet. What would be your estimate? A. We will not produce in salable sizes at Creighton this year in excess of seven and a half million feet.

COMMISSIONER COSTIGAN: Q. What is your capacity? A. We haven't any idea what the capacity of that plant is. As I have said, it is good one month and bad another, and what we will ultimately get out of it I don't know. But for this 12 months we will get approximately seven and a half million feet.

MR. MCKENNA: Q. The Pittsburgh Plate Glass estimate by Mr. Solomon ranged from 25,000,000 to 30,000,000 square feet. How does that compare with your estimate? A. I don't know where he got that figure. We are now duplicating that plant and when the new unit is in operation, if it does as well as the one now operating, we will then have 15,000,000 feet. What the ultimate capacity may be at this plant, and from changes that we will perhaps probably find necessary to make, I am quite unable to say, and no one can say.

Q. Edward Ford Plate Glass Company production was given at about 18,000,000 square feet. A. Well, I don't believe they will make anything like that. Probably 13,000,000 feet—although the Commission has these figures, I am quite sure. I would think the Ford Company production may be perhaps 13,000,000 or 14,000,000 feet this year.

Q. The estimate given by Mr. Solomon, as I recall it, was approximately 68,000,000 square feet, by the new process. A. Oh, about 350 per cent, perhaps.

Q. What would your estimate be? A. Nineteen and a half million feet including the Ford Motor.

Allowances for Breakage in Transit

Q. The Interstate Commerce Commission in one of its hearings, in Volume 21, I. C. C., at page 118, stated that concerning breakage of plate glass in transit that plate glass is seldom damaged in transit. What have you to say concerning the extent of breakage in transit? A. There is very, very little breakage in transit. The glass is packed and carried on edge. It is not flat. It rests on edge. And I do not suppose breakages in transit amount to a tenth of one per cent. That is a guess. I have no statistics on it. It is very rare that we have claims for breakage.

Q. I observe that the foreign manufacturer makes a breakage allowance. Is a similar allowance made by the American manufacturer? A. No, sir.

Q. Would you get the impression then from the fact that breakage occurs that a breakage allowance made by a foreign manufacturer would be equivalent to a refund or a rebate or a trade allowance? A. Oh, it is undoubtedly, because you can cover

insurance for breakage at far less than the allowance which the foreign manufacturer makes.

Q. The cash discount, of course, of the foreign manufacturer is different from the cash discount of the American manufacturer? A. That is two and a half and one, and ours is one.

Foreign Glass on Pacific Coast

Q. Have you any information concerning the market, say the Pacific Coast market for plate glass, and to what extent and in what degree the foreign manufacturer gets into the trade there? A. I believe the foreign manufacturers are selling half of the glass on the Pacific Coast today. You see things changed quickly with the building of the Canal, and the cost of laying glass down at any of the Pacific Coast ports is practically the same as laying it down at New York. Speaking now of the rates from Antwerp, our rates across the continent range from $1.50 from Crystal City, Mo., which is the nearest factory, to about $1.76 or $1.78 from Ford City and the American Plate Glass factory at Kane. So we are handicapped on the west coast on freight alone to the extent of perhaps 6 cents a square foot.

Q. And you must reduce your selling price 6 cents per square foot in order to meet the foreign manufacturer on anything like equal terms? A. Six cents per square foot plus the difference between their price and ours, which amounts to 8 and 9 and 10 cents in some brackets.

Q. Plus the advantage they have of the cash discount and the breakage allowance? A. That is included in the figures I gave.

MR. RAFTER (representing Belgian plate glass manufacturers): Q. You stated that in your opinion the breakage allowance made in some cases by the foreign manufacturer was in the nature of a discount or rebate? A. Yes, sir.

Q. And as a reason for that opinion, if I understood you correctly, you stated that glass might be insured against breakage for less than the allowance? A. That is my understanding, yes.

Q. Have you ever inquired as to the premiums which are charged by foreign insurance companies for insurance against breakage on plate glass? A. No, but I was referring to premiums charged in this country.

Q. Would you be surprised to know that in some cases the premiums charged are as high as 10 per cent? A. Yes, that would surprise me.

Q. You know nothing personally about the insurance premiums charged for breakage? A. I have never inquired. I do know, however, that breakages do not amount to anything like the allowances that the foreign manufacturers make. I make that statement from our own experience in importing glass and the experience of many people in the trade whom I know and who have told me about it.

Q. Now, so far as your own experience goes you are speaking of importations from where? A. From Belgium, landed at New York, Boston, New Orleans, San Francisco and the various ports of entry, particularly Detroit. There is practically no breakage of foreign glass at Detroit in the small sizes. And that is the great percentage of American imports.

Q. Have you any definite figures to support that statement? Have you checked up the records of your importations with a view to determining the percentage of breakage? A. No, because we import very little glass. The statements I make are based upon statements made to me by people in Detroit, whom I sell and who import glass, and who are in a position to know those things.

New Process Involved Heavy Investment

Q. I call your attention to an article published in THE GLASS INDUSTRY for the month of January, 1923, which I believe is in evidence as Exhibit No. 3, page 18, which reads as follows:

"Late in November (that will be 1922) the Pittsburgh Plate Glass Company, through W. L. Clause, Chairman of the Board of Directors, announced to its stockholders its intention of erecting a new plate glass plant at Creighton, Pa. This plant when equipped will have a capacity of from 15 to 20 million feet annual production. It will be erected in sections for the purpose of getting increased production at the earliest possible moment, and work thereon is already under way. The process to be installed in this plant will be revolutionary and a complete departure from the standard processes in use either in this country or in Europe. The plant when completed will have a capacity equal to one-third of the present production of the company, with the probability that it will ultimately equal a half of it."

Q. Are you familiar with the contents of the annual report to the stockholders, the annual report of the Pittsburgh Plate Glass Company for the year 1924? A. I have read it; yes, indeed.

Q. I call your attention to this statement: "Expenditures aggregating $7,652,720.09 were made during the year for extensions and improvements, the more important of which were the following:"

Q. You do not wish the Commission to infer from your testimony that the installation by you and by others in this country of this new method of making plate glass is trivial? A. Certainly not.

Q. It is an important factor in the plate glass manufacturing in this country? A. It is likely to be.

Q. It is to the extent it has already been adopted? A. No; it is to the extent that we spent money on it, Mr. Rafter.

Q. And you are continuing to spend money on it? A. We certainly are—a great deal.

Q. You do not wish the Commission to infer from your testimony that the production of plate glass by the new or continuous method does not effect important economies as compared with the old method? A. I do not wish to create that impression at all, nor do I wish to create the impression that it does effect important economies today. The plant has great promise else we would not be wasting our time and millions of dollars on it.

MR. RAFTER: Q. Did you testify earlier in the day that the breakage of glass under the new or continuous method, as compared with the old method, was about double? A. I did, for the month of October. That breakage is the breakage resulting all through the manufacturing operations, from the time the rough glass is first laid on the table until it is delivered into the wareroom, as we call it. In a plant of the old process, so-called, that loss is considered quite satisfactory if it is 15 per cent.

Q. Did you wish the Commission to understand that the average amount of breakage under the new method of production amounts to 30 per cent? A. I did not say that that was the average amount of breakage. I have no figure that will give me the average amount of breakage under the new production. I took the most recent experience we had, which was the month of October.

Commission's Data Commended

COMMISSIONER BROSSARD: Q. Do you have any objections to our data as compiled and shown in our report other than those which you have mentioned? A. I have nothing but commendation for the work of the Commission's representatives. They have not only covered the subject thoroughly but they have a grasp on the subject that has been the subject of a great deal of favorable comment in our organization—that they understood it. The report, as we see it, is an excellent report.

MR. RAFTER: Q. Mr. Higgins, have you testified about the freight equalization allowed by the American manufacturers? I think the Commission should have that information as well as the freight allowances by the foreign manufacturers. A. We equalize freight with the nearest competing factory. If, for instance, we ship from Crystal City, Mo., which is about 50 miles south of St. Louis, to Chicago, we equalize freight with Ottawa, Ill., which is the nearest plant to Chicago, and the one having the lowest rate. That practice is in use by all the American manufacturers. Glass is sold f. o. b. factory, freight equalized with the nearest plant. And those freight equalizations have been taken into consideration in the compilation of that statement about which you just questioned me. It is for the purpose of meeting the competition.

MR. RAFTER: Q. How long has that freight equalization obtained? A. Forever, I think, Mr. Rafter, except in the extraordinary times of 1920 when glass was worth fabulous sums, and then it was sold f. o. b. factory without equalization. The equalization was insignificant during that period.

MR. MCCUMBER: Q. There was some reference made, Mr. Higgins, to an article in Exhibit No. 3 in which you indicated that you would be glad to explain it. A. There were so many calling for explanations that I have forgotten that one.

Q. It is at page 18, the last paragraph. A. This is the one where I was asked to contradict our chairman, I believe.

THE CHAIRMAN: That ought to be easy. A. But not profitable. Our plan, when the Creighton plant was first thought of, was to build it in four sections. We have abandoned two of those sections, temporarily anyway. There is no thought of continuing. The first plant was completed, as I have said, last September. The second unit was started in April or May of this year, and that

will complete that plant. I just mention that to show you how far away we are even today from our original thoughts in connection with that Creighton operation.

Now, as to the capacity, which is referred to here as from 15,000,000 to 20,000,000 feet, we will have perhaps 15,000,000 feet from these two units. The units are different than were thought of at the time this statement was made, where it said that it probably will have a capacity ultimately equal to half of our total production. That undoubtedly referred to the four units which we announced when we first talked of the Creighton plant.

Ground and Polished Cylinder Glass

MR. MCKENNA: Q. In the Commission's statement of information this query is propounded, Mr. Higgins:

"Does imported ground and polished cylinder glass compete with thin cast polished plate glass, and if so, to what extent and for what purposes?" What information have you on that question? A. In the first place, there is no such thing, so far as my knowledge goes, as cylinder ground glass polished, which is the paragraph in the tariff under which this glass is entered. In the old days of the industry I believe they did polish window glass, which is cylinder flattened. It came in polished or it was polished after it got here. This happened a long time ago. And when it was so polished it was silvered for mirrors or to make the surface a little brighter, but it was essentially window glass polished. Today this one-eighth-inch plate glass ground and polished is coming into this country under this paragraph No. 220 which calls for cylinder glass polished. The only place in the tariff for a ground and polished glass is in the plate glass section, paragraph 222, I think. That is a ground and polished glass. Now, all the witnesses of the opposition have testified that it is the grinding and polishing of the surfaces that makes glass plate glass. If the surfaces are not ground and polished it is window glass or some other kind of glass.

Now, this glass is coming in, and it is important not on account of the extent to which it has already come in but because this new process which we have been discussing here lends itself so nicely to the manufacturing of 18-inch glass; and if when these new plants get going abroad one-eighth-inch glass is made under that process it might as well be imported under paragraph 228 as the glass which is now coming in under that paragraph. It is used for railway car windows. The Pennsylvania, for instance, uses one-eighth-inch plate glass in all their car windows. Sometimes in street-car windows it is used, and it is used in other railway coaches. It is used for small sizes of mirrors, and it is used for mirrors in the backs of show cases, and in any place where the thin polished plate glass is required. It is particularly adapted for use in glazing residences because, as I explained before, the sash of a residence is usually a light-weight sash and the one-eighth-inch plate can be glazed in the standard residence sash without any change and without using a heavier sash. I think it is also used for photo plates.

Consumption of Plate Glass in Automobiles

COMMISSIONER BROSSARD: Q. Mr. Higgins, what percentage of the plate glass production of the plants controlled by automobile industries is used in the manufacturing of automobiles? A. In the Ford Motor Company almost 100 per cent. At the National plant I should imagine the National Company use perhaps 75 or 80 per cent of the glass which they make for their own purposes in the general course of business. The balance of it is sold, and it consists of some small sizes. They have to retain some for the mirror trade and jobbing trade who give them diverse specifications. Mr. Gaffney can answer as to his own plant, the American Plate Glass Company.

MR. GAFFNEY: That is the Durant interests. It is 50 per cent.

COMMISSIONER BROSSARD: Q. That glass does not enter upon the open market for sale at all? A. It does not. You may be reaching this point, but in case you do not may I make a suggestion? In one table here you figured the percentage of imports and American production, and you show that imports in 1925, for the first six months, are 14.6 per cent of the American production. That does not mean 14.6 per cent of the competitive business in the United States because here is the Ford Motor Company, we will say, with 13,000,000 feet or 12,500,000 feet which is absolutely non-competitive, and the National Plate Glass Company with a production of perhaps 13,000,000 or 14,000,000 or 15,000,000 feet so far, and a much larger production coming along, largely devoted for their own purposes. Mr. Gaffney's production, of which half of it is for his own production, must also be considered. So you see the percentage of glass coming into the competitive business, the business that is offered to the Pittsburgh Plate Glass Company and the other manufacturers here is very much larger than your table shows.

Q. What percentage of the plate glass production of the remaining plants is sold to automobile companies? A. The automobile manufacturers perhaps use half of the glass of the country.

MR. MCKENNA: 52 per cent of the production of glass is used by the automobile industry.

Quality of New Process Plate Glass

COMMISSIONER BROSSARD: Q. How does plate glass produced by the so-called continuous process compare with that made by the old method in quality? A. There again we have the question of grading. If by your question you refer to quality as it is received in the sheet delivered to the ware-room by the machines the quality is not so good.

Q. I have reference to the finished quality, that is put on the market. A. Absolutely just the same, because the defects are eliminated in the grading and glazing process.

Q. It is not softer? A. I wouldn't say that there is any difference in the texture of glass or the chemical composition that would make it a selling point for or against the product. It is true that some soft glass stains. That is quite true. That is the tendency of tank glass to stain, but in the year or more that we have operated our Creighton plant we have had practically no trouble that way. So I cannot say that that is a practical consideration.

Q. Now, there is just one other question that I want to get back to in the final argument here. What would you think of allocating costs on the basis of sales values of the different sizes of glass for the purposes of these three brackets? A. I don't see where we would get any place in doing it. Now, we have a bracket here that sells at 18 cents, and tomorrow that bracket may sell at 16 cents or may sell at 20 cents. The conditions vary and the prices are moved around. That might have the effect possibly of marking the size up on large glass provided the foreign manufacturer did the same thing. But we cannot arbitrarily ourselves cut out a certain part of our production and theoretically add a part of our cost of production to another part and sell that high-priced glass in competition with a man who figures his glass on the average production for his whole plant.

Q. In other words, the prices you sell the separate pieces of glass for in this particular industry are entirely independent of the costs of production of the individual pieces of glass? A. It has nothing to do with it whatever.

Q. As a direct relationship to the total cost of production? A. Precisely.

Q. Of the total amount of glass? A. You have it exactly.

Graduated Duties a Relic of Congressional Dark Ages

COMMISSIONER GLASSIE: Q. Will you explain one thing, if you can? Why did Congress graduate this duty after all these hearings and recitations on behalf of the glass industry? Why did it graduate them? A. We have talked to Congress until our throats were sore trying to tell them it was wrong. Why they persist in doing it I don't know. They have done it in every Act, so far as I know, back forever to the dark ages. Why it is done I do not know.

Mr. Solomon Recalled as Witness

MR. GALLERTA representing the Association of Foreign Glass Consumers): Mr. Solomon will take the stand, please. Mr. Solomon, on Friday of last week did you go through the Highland Park and River Rouge plants of the Ford Motor Company, and did you have certain conversations with high officials of those plants? A. Yes, sir. Last Friday I took the opportunity during the recess which the Commission had announced to once again visit the plants of the Ford Motor Company at Highland Park, and for the first time also to visit the River Rouge plant of that company.

Q. What did you learn on that visit about the cost of production by one process, by the continuous process, as against the cost by the old process? A. According to the information given to me by several of the high officials of the company, also the superintendent of both glass plants, it only confirmed and emphasized the fact that the new process of making plate glass is even better than I stated myself last week.

I saw on the bulletin board at the glass plant at River Rouge

the record which they keep, a daily record of the percentage of glass which they receive from the day's production and of the various qualities and of the glass of good quality which they call their A quality, and which is fully equal to the best glazing quality glass that is made, they obtained from last Wednesday's production, which is the last day which they had recorded, 86 per cent of the total glass made that day.

Then I inquired as to the rest of the 14 per cent, and they informed me that about 8 per cent was in the smaller sizes, too small for their particular use, and about 6 per cent was waste and cullet and poor quality.

Comparison of Methods

Q. Were you told anything about the cost of producing by one method as against the other? A. At River Rouge the superintendent told me they employ altogether about 475 men, producing 40,000 square feet per day, which would make the year's production from ten to twelve million square feet—perhaps a little more than that, because they make the rough plate every day in the week, and they grind and polish only five or five and a half days a week, but they can grind and polish faster than they can cast. The production, as they told me, was 40,000 square feet per day, although on the bulletin board they had marked on Wednesday 43,000 square feet of glass.

Q. Were you told anything about the saving of waste in one method as against the other, or did you see anything about the saving of waste? A. Comparing these figures alone with the statement made by my friend Mr. Higgins it would indicate that the percentage of waste was considerably less than under any other method ever devised before. And, furthermore, I asked the superintendent if he ever visited any other plant, and he told me he had been down to Allegheny, and so far as he knows the percentage of waste there under the old method which they use at that plant was larger than at the new plant. I spoke to Mr. Avery and asked him whether he found economies and satisfaction from the new method, and he said there was no comparison, that the new method was far superior in every respect, and for that reason the fact that they are building the new plant is an indication of it.

Q. Did anyone tell you anything there about the cost of producing glass being lower under the new method than under the old? A. Yes, sir. The cost of producing glass can be figured out from the figures which they gave me, and it only confirms what I testified to last week, that the saving is enormous.

Percentage of Defective Glass

Q. What did you hear or what did you learn about the percentage of defective glass coming from the machines to the warehouse? Is that greater under the new method than under the old? A. No; I just gave you the figures which they gave me. 86 per cent that date of A quality glass and only 6 per cent waste and poor glass, which is far less than under the old method. Mr. Higgins mentioned, I believe, that the waste there was about 30 per cent.

Q. That was the percentage of glass coming from the machines and not the finished glass after they had taken it from the warehouse. Now, did you learn anything about the cost of a factory under the new method as compared with the cost of a factory under the old method, a factory equipped? A. Yes, sir. Mr. Avery gave me the cost of the plant at River Rouge. I don't know whether I ought to mention it because I don't know whether he wants me to keep that confidential. However, in listening to the testimony which Mr. Eckenrode gave the other day as to the cost of his new plant at Ottawa, I would say that the cost of the new plant producing the same amount of glass would be easily 60 per cent less than the cost of the plant under the old method for the same capacity.

MR. RAFTER: Q. Did you, while you were recently at the Ford Motor Company plants in Highland Park and River Rouge, receive any information regarding the comparative cost of producing plate glass by the new and the old methods? A. In a general way I was informed by Mr. Avery that the cost is considerably less under the new method.

Q. Did he give you any definite statement as to how much less, or are you at liberty to state that? A. He did, but I don't think I ought to reveal that, because he may want to keep it confidential.

Q. If the Commission wants that information will you supply it confidentially? A. Yes, I will be glad to.

Q. Have you any other statement to make for the information of the Commission? A. I asked Mr. Avery as to shutdowns in their tanks, etc., and he pointed to one of the tanks, or two of them, rather, and he said, "Those tanks have been running for eight months straight without any trouble or difficulty of any kind, and they are still making glass every day."

There was also a statement made by Mr. Higgins which I found very interesting, and that was that the glass made at their plant at Creighton is 70 inches wide. In that case I would say that that would probably take in about 90 per cent of all the glass requirements of the country—perhaps even a higher percentage. Glass 70 inches wide made in a continuous method, making it in long lengths, would cover almost fully 90 per cent, and perhaps more. As a matter of fact, our experience has been higher.

Western Wholesaler Testifies

MR. GALLERT: Charles C. Belknap will please take the stand.

Q. What is your business? A. I am in the wholesale glass business in Seattle, Wash., and import plate glass.

Q. Do you know at what price, as compared with the imported price of plate glass landed in Seattle, American plate glass is being regularly sold for in Seattle? A. Plate glass is being sold in Seattle for the last two years at 10 to 30 per cent below our absolute cost of stock sheets, cut sizes.

Q. And when you say that you mean less than the cost to you? A. Yes, sir.

Q. When you buy direct from the Belgian factories? A. Yes.

MR. MCKENNA: Q. Isn't it a fact that the jobbers on the Pacific Coast are in practically a trade war with each other? A. Not particularly, no.

Q. You say that the price of the American glass is 10 to 30 per cent below your absolute cost of stock cut sizes? A. Yes.

Q. And still you buy the foreign glass exclusively? A. Entirely, yes, sir.

Q. And pay a penalty of from 10 to 30 per cent for that privilege? A. We simply had to meet conditions, that is all. Our competitor is selling glass from 10 to 30 per cent below.

Q. Where do you sell your glass? If they are from 10 to 30 per cent below you how do you stay in business? A. We sell some glass to show-case people and people of that character where we get probably a little more, but 60 to 80 per cent of our glass is sold by W. P. Fuller & Company, as I say, 10 to 30 per cent below our actual cost, and the glass comes from the Pittsburgh Plate Glass Company.

Q. Why don't you buy from Fuller? A. Simply because Fuller would not sell me if I wanted to buy.

MR. PRESMONT (representing American Plate Glass Corporation): Q. Then, as a matter of fact, do the profits which you make in part in the sale of glass larger than 250 inches carry you along to make up for this 10 to 30 per cent loss? Where do you make up this 10 to 30 per cent loss you have been talking about? A. We do not make it up. It has been a losing proposition. We try to offset the difference on the other kinds of glass that we handle.

Mr. Belknap was the last witness to appear. Following his testimony, Chairman Marvin reverted to the request made on the first day of the hearing by David J. Gallert, who appeared for the Association of Foreign Glass Consumers, that the Commission adjourn the hearing and ascertain new production cost figures on the basis of the so-called new continuous process of making plate glass, which was not in commercial operation at the time the Commission's preliminary statement of costs was compiled and therefore was not covered by the statement. After a discussion with counsel representing the various interests it was decided to postpone the Commission's decision on the motion made by Mr. Gallert, and December 21 was set as the date by which attorneys for both sides should submit in writing arguments in connection with the request for an adjournment of the hearing and further prosecution of the investigation.

The hearing was then declared closed.

Up to the time of going to press with this issue, no decision on Mr. Gallert's motion had been announced and what course the Commission will follow regarding further investigation of the so-called new process is not known.

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ADVERTISING RATES SENT ON REQUEST

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Atlanta Meeting of the American Ceramic Society

There are many indications that the coming meeting of the American Ceramic Society at Atlanta will surpass in importance and in attendance any previous meeting of the society. This applies especially to the Glass Division, which in a few years' time has grown to be one of the foremost sections of the organization.

A list of papers to be presented at the Glass Division's meetings scheduled up to the time of going to press, and to which undoubtedly others will be added, is published elsewhere in this journal. These papers by experts in their respective lines, promise to be of immense value and will prove to be instructive and interesting to the members present.

It is not only from the papers read that members will derive benefits. Great gain will be obtained from the discussions following the papers and above all from the mingling of many minds, interested in the subject of glass and related branches of ceramics. The free interchange of ideas will open up new viewpoints that will more than compensate members for the time spent at the convention.

It is hoped that many glass makers and scientists will make an effort to spend the week of February 8th at the Atlanta meeting.

Specifications and Methods of Testing

As methods in industry are being perfected there arises a growing demand for specifications covering raw materials and finished products. Specifications become more urgently needed as the action of certain constituents becomes known. It may be said that the completeness with which specifications can be drawn up is an index of the state of development arrived at in an industry.

Just as important as standards are the methods by which tests are carried out. It is useless to define standards when methods of testing are lacking. To fix specifications without also giving explicit directions for testing is to leave a job before it is finished.

The Committee on Standards of the Glass Section of the American Ceramic Society, in cooperation with the Bureau of Standards, has done a valuable piece of work in proposing specifications for silica sand. Presumably standards for other raw materials of the glass industry will follow. However, the value of this undertaking to the glass industry would have been greater if definite methods of analysis had been proposed and tested by the committee. It will not do to refer to a few works on chemical analysis, and to leave the selection of the proper method to the initiative of the chemist.

What is needed in addition to specifications is detailed instructions as to the methods of testing to be used. These instructions should be the result of careful comparison of all methods available, from which the most accurate and the most rapid procedure should be selected as the standard method, to be used throughout the industry for routine testing as well as to settle disputes.

We are living in an age of standardization. Whether he likes it or not, the chemist engaged in industrial work

will have to meet the demands for rigid standardization of his methods, the same as the engineer.

It is not expected that motion studies will be made of the chemist's work. Let us hope not. But standardization of analytical methods of the glass industry, correlative to specifications, will come, and the more intelligently the methods are drawn up, the better specifications will be adhered to.

Trade Relations with Russia

A meeting of considerable importance recently took place between representatives of American and Russian financial and commercial institutions, gathered at a dinner at the Bankers club of New York. The dinner was given by officials of the Chase National Bank which has been instrumental in financing the Soviet's purchases of American cotton and which has participated in a number of other Russian commercial transactions in the last two years.

The fact that the leading European nations have established relations with the Russian Soviets is an indication that the latter are now considered a stable government. Closer relations between Russia and the United States are of considerable interest to the glass industry. Producers of automatic glass making machinery have been among the first to recognize the opportunities existing in Russia, with the result that large purchases of machinery and supplies have been made in this country.

Better relations with Russia will facilitate larger participation in the rebuilding and developing of the industries under control of the Soviets and it is believed that eventually a way will be found to establish full commercial and diplomatic connections with the present Russian government.

The Way a Lower Tariff Would Work

An interesting fact brought out by witnesses for domestic manufacturers of plate glass at the recent Tariff Hearing at Washington and not refuted by the opposition, was that small sizes of plate glass, on which the importers and foreign manufacturers are particularly anxious to obtain lower duties and which are an unavoidable and undesirable product incident to the production of large sizes by either the old or new manufacturing process, have practically always been and are now sold under the present tariff at prices below actual cost. This is the result of a limited market on the one hand, and on the other hand the impossibility of controlling the quantity produced, because small sizes result from breakage and are not made small intentionally.

Any reduction in duty on small sizes of plate glass would bring into the country floods of foreign glass at cut prices, and the American manufacturers would be subjected to additional losses on sizes already being sold below cost, for which they would be compelled by the laws of self-preservation to compensate themselves by charging higher prices for the larger sizes.

Thus, lower duties on small sizes would open up a new market here for the foreign manufacturer and help him to solve his own "small sizes" problem at the expense of the American consumer of larger sizes.

Technical Consultation Service

QUESTION 87.—OMISSION OF BORAX FROM GLASS BATCH.—We note under the Technical Consultation Service of your September issue that in answer to question 77 you recommend a changed glass formula from which borax has been eliminated. We would appreciate any information you can give us as to your reasons for omitting it from revised formula in question.

ANSWER—We are well aware of the value of borax to produce certain highly desirable qualities in glass, and have pointed out, from time to time, the advantages of borax for certain purposes. A reference to borax appeared in the May 1925 issue.

However, we would not wish to create the impression that borax should be added to every variety of glass batch, just because it is of value in some cases. We do not need to point out that the addition of boron in the form of borax or boric acid is quite expensive. There are numerous glasses that do not require boron. We would certainly not advise any glassmaker to add borax to a batch for window, plate or bottle glass. But we would recommend it for making chemical glassware, baking dishes, thermometers, lamp chimneys, gauge glasses, high tension insulators and so forth.

The glass which our subscriber is producing happens to belong to that kind of glasses that does not require boron. The addition of borax to the batch would be an extravagance.

The batch in use was radically wrong, and produced unsatisfactory glass, in spite of the fact that borax was used. We suggested a well balanced batch of the proper chemical composition.

The glassmaker is facing problems somewhat similar to those of the metallurgist. Modern glass making machinery requires glasses of a definite viscosity and working range. These two properties depend to a large extent on the composition of the glass. We do not yet know all that is necessary to control the properties of glass but we are making great progress.

The influence of boron is known to some extent and is being utilized. But to advise the use of borax when it is not needed would be as unreasonable as to suggest to a metallurgist to use chromium or tungsten for every kind of steel.

Requests Investigation of "Demi-Plate" Advertising

The Federal Trade Commission has been requested by Royal T. McKenna, of Washington, D. C., to order an investigation of advertising of "Demi-Plate" glass. Mr. McKenna is an attorney and counselor at law, and at the recent hearing of the Tariff Commission in Washington to determine the foreign and domestic cost of the production of plate glass and mirror plate, he represented the National Plate Glass Company, the Edward Ford Plate Glass Company and the Standard Plate Glass Company. The complaint made to the Federal Trade Commission is not brought by Mr. McKenna as a representative of any client, but merely in his capacity as a citizen of the United States. The text of the complaint is as follows:

Federal Trade Commission,
Washington, D. C.

Dear Sirs:

Ordinary window glass is being advertised as "Demi-Plate" glass in trade journals throughout the United States. This constitutes an unfair method of competition and seems to warrant an inquiry by the Federal Trade Commission in the interest of the public.

In the Matter of the Investigation of the Costs of Production of Cast Polished Plate Glass and Mirror Plates, hearings in which were held at Washington, D. C., November 23, 24, 30 and December 1st, 1925, testimony was submitted to the United States Tariff Commission showing that the glass advertised as "demi-plate" glass "is ordinary window glass and nothing else"; (transcript of testimony, page 498); that "demi-plate" is not plate glass (199); that "demi-plate" is competitive with plate glass; that "demi-plate" glass is not ground or polished (497); that a distinguishing characteristic of plate glass is that it must be ground and polished (497, 504, 351), and that "demi-plate" glass is another name for crystal sheet glass (200).

Abraham Solomon, an importer of this so-called "demi-plate" glass, whose place of business is 199 Wooster Street,

New York, testified at page 497, of the hearings before the United States Tariff Commission on November 30, 1925, that

> "'demi-plate' is simply a nickname started by some one who imported it into this country. They might as well have called it any other name."

The same witness testified, on page 498, that "'demi-plate' glass is ordinary window glass and nothing else. It is ordinary window glass, that is made in this country by the American Window Glass Company, for example, for 15 years or more."

The Glaziers' Journal, a monthly publication of the glass industry, 209 Columbus Avenue, New York, N. Y., issue of November, 1925, shows that L. Solomon & Son, 199-201 Wooster Street, New York, and Lafayette Mirror Company, 68-76 Rutledge Street, Brooklyn, New York, advertise "demi-plate" glass and "Vitrea Demi-Plate" glass. The glass is sometimes called Vitrea glass according to Abraham Solomon, the witness hereinbefore referred to, on account of "Vitrea being the name of the manufacturer" (tr. 497). A copy of *The Glaziers' Journal*, issue of November, 1925, is attached to this letter.

Attached to this letter is a notice, dated October 8, 1925, issued by the National Better Business Bureau, Associated Advertising Clubs of the World, 383 Madison Avenue, New York, showing that "HEAVY WINDOW GLASS IS BEING SOLD AS AND FOR PLATE GLASS."

Also attached to this letter is a clipping from *The Glass Worker*, a trade journal, published at Pittsburgh, Pa., issue of October 31, 1925, the title to which shows that there has been started a "CAMPAIGN TO STOP USE OF HEAVY WINDOW GLASS AS POLISHED PLATE GLASS IN BUILDING IN NEW YORK."

Advertising or selling window glass for plate glass is deceptive, and misleading, and seems to justify an inquiry or investigation by the Federal Trade Commission in the interests of the public.

This complaint is not brought by me as a representative of any client, but merely, in my capacity as a citizen of the United States.

Very truly yours,

Royal T. McKenna.

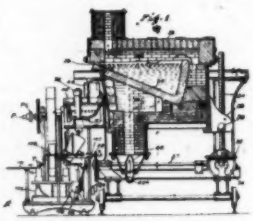
Washington, D. C.
January 2, 1926.

Recent Patents

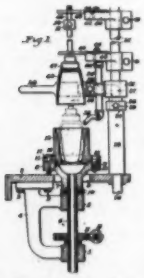
NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C. Price 10c each

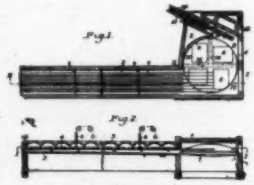
GLASS-FEEDING MECHANISM. U. S. 1,564,909. Dec. 8, 1925. Theodore C. Steimer, deceased, by Charles M. Steimer, executor, Zanesville, O., assignor, by mesne assignments, to Hartford-Empire Co. Filed 2/12/10. An apparatus including a melting and delivering furnace which is pivoted at 31 and pours out the glass constantly at a fixed head. The glass flows in an unbroken stream into the interrupter chamber 45, where, by means of a reciprocating plunger 58 it is divided up into charges which are delivered through the funnel 63 into a series of molds M, where each charge of glass is automatically pressed and delivered as shown at T in completed form.



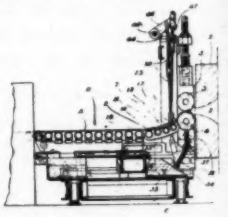
METHOD AND APPARATUS FOR RE-FORMING GLASS ARTICLES. U. S. 1,566,520. Dec. 22, 1925. Harry A. Bridges and John W. Lamparter, Sapulpa, Okla., assignor to Bartlett-Collins Glass Co. The glass article is fastened to the punty by sticking. The article is then reheated to glaze and soften the same. The punty is then lowered to enter the end of the article into the revolving cup. As the re-shaping or re-forming progresses, the punty is gradually lowered until a stop collar adjustably secured to the stem by means of a set-screw engages the lower guide plate. The adjustable stop regulates the depth to which the article enters the cup member. When the article has become set in the new shape, indicated in dotted lines in Fig. 1, the punty is raised to remove the article from the re-forming member and the article is then removed from the punty.



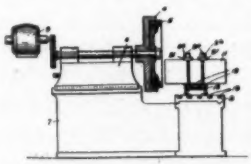
METHOD AND APPARATUS FOR FLATTENING AND ANNEALING SHEET GLASS. U. S. 1,567,756. Dec. 29, 1925. Louis R. Schmertz, Jeannette, Pa., assignor to Window Glass Machine Co. Filed 8/5/24. In the method of making flat sheet glass, the steps consisting in supplying unflattened glass to a flattening oven, flattening the glass therein, passing it from the oven through a lehr to anneal and cool the glass, supplying heating gases to the flattening oven, passing heating gases from the flattening oven through the lehr in streams above and below the glass, so regulating the relative rate of flow of the gases above and below the glass as to equalize the rate of cooling from the two faces of the glass therein, and preheating the unflattened glass supplied to the flattening oven to compensate for the increased temperature of the surfaces contacting with the glass in the flattening oven induced by the regulation of the gaseous flow from the flattening oven through the lehr.



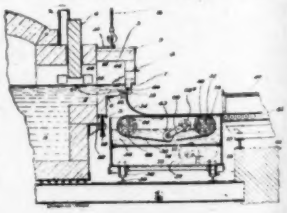
APRON FOR PLATE-GLASS MACHINES. U. S. 1,569,082. Jan. 12, 1926. John H. Fox, Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Co. Filed 1/22/24. Improved apron construction which may be adjusted to varying angles to meet varying conditions, and which may readily swing completely out of the way in emergencies, such as that which arises when a large mass of glass is drawn through the forming rolls and would tend to overheat and injure the rolls constituting the apron or the rolls in the transfer table in advance of the apron.



MEANS FOR GRINDING BLOCKS. U. S. 1,566,744. Dec. 22, 1925. Arthur E. Gray, Pittsburgh, Pa., assignor to Pittsburgh Clay Pot Co. The combination with the table of a grinding machine of a supplemental work supporting table, fastening means secured to said grinding table and adapted to engage the ends of said supplemental table to secure it in predetermined relation to said grinding table in either of its end for end reverse positions and means for securing work pieces on said supplemental table with a plurality of faces exposed for grinding.

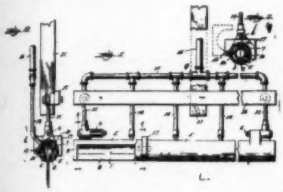


APPARATUS FOR MAKING SHEET GLASS. U. S. 1,569,086. Jan. 12, 1926. Halbert K. Hitchcock, Pittsburgh, Pa., assignor of one-half to Hitchcock Experiment Co. Filed 12/8/23. The glass sheet 34 is received upon an endless belt 35, preferably of cotton duck or asbestos and having its lower flight located in a tank 36 provided with a bath of water. The glass ribbon in passing from the rolls 15 and 16 to the belt assumes a curve somewhat as indicated in Fig. 1, and the distance from the rolls to the belt and the temperature of the glass are so adjusted that in the period of movement from the rolls to the belt, the glass is stretched and reduced

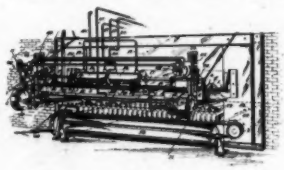


in thickness to its final dimension, and its lower surface, by the time it reaches the belt, has attained a degree of hardness such that it will not be marred by contact with the wet fabric belt.

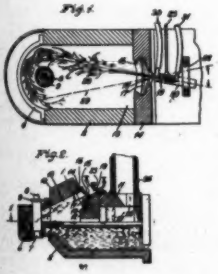
GLASS BAIT. U. S. 1,567,300. Dec. 29, 1925. George G. Roberts, Washington, D. C., assignor to the Virginia Plate Glass Corporation. Filed 5/11/23. A bait for drawing glass in plate form, consisting of a pair of separable sections pivoted together along their longitudinal edges and having a longitudinal slot between their lower meeting edges and an enlarged interior cavity extending the length of the slot, removable clamping means being employed to hold the sections together in closed relation. In operation, the bait-bar is lowered in the usual manner until the lower edge of the bar is immersed in the molten glass, thus sealing the slot; then air is exhausted from the interior of the bait-bar by means of the piping, whereupon the molten glass is drawn up to fill the slot and the cavity; then the bait is ready to be raised slowly in the usual manner.



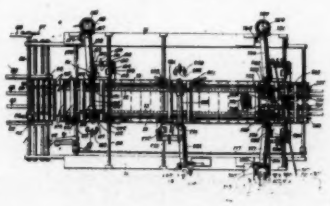
LEHR-FEEDING APPARATUS. U. S. 1,567,725. Dec. 29, 1925. Ira H. Freese, Clarksburg, W. Va., assignor to Hazel-Atlas Glass Co. Filed 11/17/23. A mechanism that will lift bottles, carry them into the lehr, and deposit them on the lehr pans, thereby avoiding any tendency to overturn them. If ware of relatively large diameter is to be handled, the pick-up feature may be omitted, and the apparatus may be quickly changed into a feeder of the pusher type. When employed as a pusher it is only necessary to swing the pusher bar from its inoperative position to its operative position. The pusher bar is lowered behind a row of ware, and as the carriage is moved toward the lehr front the pusher bar will push the row of articles into the heating zone of the lehr; and the bar will then be lifted and carried back to feed in the next row of ware.



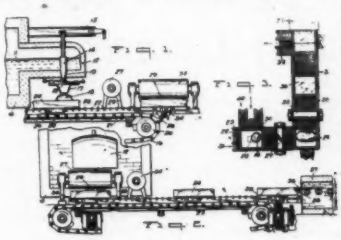
METHOD AND APPARATUS FOR HEATING GLASS FEEDERS. U. S. 1,568,021. Dec. 29, 1925. Everett O. Miller, Hartford, Conn., assignor to Hartford-Empire Co. Filed 3/14/25. Apparatus for feeding molten glass, comprising a conduit or forehearth, a discharge spout provided with a downwardly opening discharge outlet, a rigid vertical member for controlling the discharge of glass through said outlet, a cover for the forward portion of forehearth and spout, a burner block disposed at the upper end of said channel, a laterally oscillable burner arranged to project flame through an opening in said block, and a stack at the rear of said burner block for withdrawing products of combustion from said forehearth.



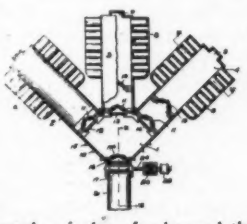
GLASS-BODY-FORMING MACHINE. U. S. 1,569,652. Jan. 12, 1926. Hans N. Halversen, Vineland, N. J., assignor to Kimble Glass Co. Filed 2/2/22. An improved mechanism for producing automatically rounded bottom glass or similar bodies, such as test tubes, ampuls, bottles, and the like. It also provides means for automatically forming the outwardly-flaring smooth-edge lips at the opposite ends of such bodies; test tubes, for example. The machine consists of two parts or sections, the one designed to provide the lips on the bodies, and the other to form the rounded or bulged bottoms, it being understood that the glass blanks are of double length and divided by the machine into two of the hollow bodies to be produced.



SHEET-GLASS ROLLING APPARATUS. U. S. 1,569,466. Jan. 12, 1926. John L. Drake, Toledo, O., assignor to the Libbey-Owens Sheet Glass Co. Filed 4/30/25. Mechanism for creating gobs or charges of glass of a predetermined size, the gobs of glass being adapted to be reduced through several stages to sheet form, the said sheets having predetermined dimensions and being capable for use as plate glass blanks.



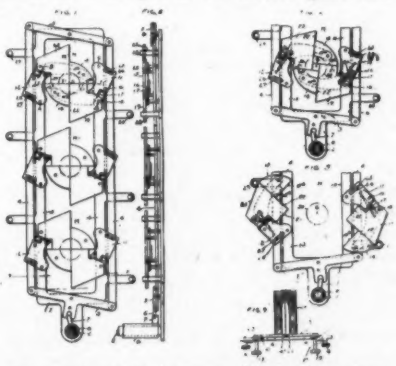
GLASS-TANK CONSTRUCTION. U. S. 1,569,152. Jan. 12, 1926. Thomas H. Swartzlander, Aspinwall, Pa., assignor to Pittsburgh Plate Glass Co. Filed 3/25/22. The object is to retain all the advantages of the present regenerator tank of standard size and proportions, while at the same time increasing to a large extent the quantity of properly melted and fined glass produced, this being particularly necessary where the sheet glass is to be produced in a continuous ribbon of considerable width, as such a method calls for a supply of glass far beyond the capacity of the ordinary tank, which, as above pointed out, it is not practical to increase in size beyond certain more or less well defined limits.



Cutting-off Device of Novel Design

A United States patent, No. 1,568,531, was granted on January 5, 1926, to Anita S. Reynolds, of Greenwich, Conn., who, with J. N. Reynolds, has designed apparatus for closing an opening in such a manner that the center of the opening will be the finish of the closing movement

The invention is intended especially for use in closing the bottom of the blank mold in a bottle-making machine of the type in which the mold is submerged in the molten glass and a vacuum



created in the mold which becomes filled with glass. The particular embodiment of the invention illustrated herewith is a frame fitted with three cut-offs for use with a triple bottle mold.

One object of the invention is to provide means whereby a closing movement of the members of the closure mechanism will form the boundaries of an opening, which boundaries will be reduced toward a common center until the opening is obliterated, and a flat, plane surface will be produced without openings between the members.

Further objects are to provide means whereby the column of glass depending from the bottom of the mold as it is withdrawn from the molten glass will be cut from the outside to the center thereof; "whereby any crowding will be toward the center of the mold, where the glass is hottest, to provide means whereby the cutting device will form the base against which the article is blown, and to provide means whereby the said bottom will be a plane surface and devoid of gaps, cracks, seams, or other spaces; and to provide means whereby the cutting or severing device may be moved from beneath the mold whereby the latter may be again dipped into the pool of molten glass."

Cutting Expenses by Installing New Equipment

How Mechanical Gas Producers Reduce Operating Costs

By Scott Davidson*

Six months ago we installed two Type LH8 Wellman-Seaver-Morgan gas producers to take the place of three hand-fired producers. Although we had figured that two size 8 producers would be required to handle the work done by the three hand-fired producers, one has easily handled our load of 2,750 lbs. of coal per 24 hours, and we believe it could handle a load of 3,300 lbs. The one producer has been in constant operation for six months. The other is held in reserve.

The coal from which our gas is manufactured is mined here in Hillsboro, Illinois. We buy the nut size, 1½" to 2½". This coal is very well adapted for the manufacture of producer gas and gives us very little clinker trouble. It has the following analysis:

Moisture	8.02%	Fixed carbon	42.47%
Volatile matter	39.68%	Ash	9.83%

Water Cooled Poker Keeps Fuel Properly Distributed

Coal is unloaded by means of a traveling electric crane with clam shell bucket. The same bucket lifts the coal to the steel hopper from which it flows to the automatic feed on the producer. This automatic feed requires no attention and delivers the coal to the fire at a constant rate.

The water cooled poker which constantly moves through the fuel bed prevents holes in the fuel bed and keeps the fuel properly distributed. This prevents the burning of the gas in the producer and the formation of clinkers. When the water has passed through the poker it flows out over the cast iron top of the producer thereby cooling it also.

The plow in the bottom of the producer scrapes the ashes from the sides of the shell and shoves them out into the pan beneath. When it is desired to remove the ashes another plow is let down into the pan, and the ashes are scraped out and fall into a wheelbarrow.

Temperature of Gas 1350° F.

Steam at 34 lbs. gauge pressure is used on the blower line. With the temperature of the air blast at 138° F. the coal does not clinker. Every hour we shut down the producer for a half minute to take readings for the daily log.

This morning (November 12, 1925) the log shows the temperature of the gas in the transportation line to be 1,350° F., the air blast temperature 138° F., the steam pressure 34 lbs., the distance from the top of the producer to the fire line 45" to 48", the thickness of the fuel bed 4" to 7", the distance from the top of the grate to the fire, or thickness of the ash bed, 16" to 21".

In the furnace the temperature is 2,500° F. in the melting end and in the working end it is 2,100° F. We burn 27 tons of coal in 24 hours.

Water Seal at Base

The steam and air blast is blown through a pipe to the bottom of the producer and is forced up through the grates. If the blower fails the producer is equipped with an auxiliary blower so that live steam can be blown into the fire.

The base of the producer is sealed by the water condensed from the steam. In the event of an explosion of the gas in the producer, the water seal is blown out and no damage is done.

Once each 24 hours the transportation line is blown out with steam at the point where it leaves the producer. This cleans most of the soot from the line. The soot so removed falls down into a leg of the line closed by a damper and can be removed in wheelbarrows. Once a week the producer is shut down for about two hours, and the entire transportation line is blown out.

Present Operating Cost $36.93 Per Day

One operator and one ash handler per shift operate this producer as compared with 9 gas makers and 2 ash men with the old equipment.

The total operating expense of one producer is $36.93 per day, or $1.03 per ton of glass manufactured. This figure, as shown in the attached tabulation, includes depreciation, interest and repairs on two producers, power and operating labor. A 3 H. P. motor furnishes all the power required.

We now average 1 ton of glass to ¾ ton of coal. We have melted 60 tons of raw material—sand, soda ash, lime, broken glass, and color—with 31 tons of coal in 24 hours.

Save $10,136.05 Over Hand Fired Producers

Operating costs of the hand-fired producers amount to $52.20 per day. This is $15.28 more than the daily operating cost of the new producers.

In addition to this saving of $15.28 per day in operating cost, we save at least 5 tons of coal per day worth $2.50 per ton because of better efficiency. The total saving is $27.77 per day or $10,136.05 per year which is a return of 30.9% on the investment.

In glass manufacture a constant flow of gas, of a constant quality and temperature is necessary. An excess of gas is as bad as a deficiency. If the furnace is crowded it will smoke and unless there is a constant gas temperature the furnace temperature will vary and breakage will increase.

The producer substitutes mechanical production for hand methods. In 24 hours the temperature of the gas does not vary more than 20° F.

Easy to Handle

This producer is compact, well-built, and simple to operate. Our men who had never seen a mechanical producer before were able to handle it properly in a few days.

Repair costs are very slow. So far after six months' operation our only repairs have been two ash scrapers and a few shear pins. The shear pins are a fine thing for keeping down repair bills. For the first few days we operated the producer we had a lot of clinker trouble with the inferior coal we were then using. In two days we broke 50 shear pins.

A shear pin in the automatic feed mechanism prevents damage when some foreign substance gets caught in the feed.

At present the gas from this producer is used only in our melting furnace, but very likely we shall soon pipe it to our annealing lehrs also.

Operating Cost—2 Type LHS Gas Producers

Depreciation—$32,800.00 ÷ 10 year life	$ 3,280.00
*Average interest at 6%— $\frac{11}{10} \times \frac{\$32{,}800.00 \times .06}{2}$	1,082.40
Repair and maintenance allowance	400.00
Total fixed cost per year	$ 4,762.40
Fixed cost per day—$4,762.40 + 365 days	$ 13.05
Power—54 K.W.H. @ 2c per K.W.H.	1.08
Labor—3 operators × 8 hrs. each × 50c per hr	12.00
3 ash handlers × 8 hrs. × 45c per hr	10.80
Total operating cost per day	$ 36.93
Cost per ton of glass made—$36.93 ÷ 36 tons	$ 1.03

Savings Effected by 2 Wellman-Seaver-Morgan Gas Producers

Depreciation, interest and repairs on 3 hand-fired producers per day	$ 8.20
Labor—11 men × 8 hrs. × 50c per hr	44.00
Total cost per day	$ 52.20
Operating cost 2 W-S-M producers	36.93
Saving per day in operating costs	$ 15.27
Saving in coal—5 tons × $2.50 per ton	12.50
Total saving per day	$ 27.77
Annual saving—$27.77 × 365 days	$10,136.05
Return on investment	30.9%

*Factory Manager, Schram Glass Manufacturing Co., Hillsboro, Ill.

*Allowing for interest earned by depreciation reserve.

Selection of Fuel for Heating*

Viewing the Problem from a Different Angle

Selection of a suitable fuel, or electricity, for heat-treatment processes should be made with appreciation of the fact that the value of the result sought is to be measured by the quality and over-all cost of the finished product; not merely by the price or consumption of fuel or electricity, temperature record, heat balance, or some such incidental phase of the heat-treatment process as a whole.

The real problem, from the manufacturer's point of view, is that of producing a quality product at low cost, and the use of such form of fuel, or electricity, and such character of equipment for heating, cooling and handling, as will produce this result under his specific manufacturing conditions.

Any method of selection, based on abstract comparison of different forms of fuel, or electricity, and the claimed advantages of one over the other, is inaccurate, misleading and out of date in fact, though apparently not in effect. Each form has its field of usefulness, as well as its limitations, all of which vary with the nature of the heating process, the type of furnace or other heating appliance, the method of operation, the manufacturing requirements, the plant conditions, and many other factors, any one of which may influence the choice under specific conditions.

Much of the prevailing conflict of ideas on the subject is due either to a misunderstanding of the relation of the so-called "fuel problem" to the real problem that confronts the heat-treating department—(i. e., the quality and over-all cost of the finished product); or to commercial propaganda calculated to further the use of some particular form of fuel or electricity, or some special form of apparatus or material to which that specific form of heat energy may be adapted.

The situation is very confusing to one concerned with the selection of industrial heating equipment properly adapted to his specific requirements. He is confronted with the conflicting claims of enthusiastic advocates of many different forms of fuel, furnace material or heating apparatus; and with evidence or opinion in tales of success or failure that may be far removed from proof or fact. He longs for recourse to a recognized Court of Appeals for an unbiased opinion of the relative merits of the many different forms of fuels; of methods of heating electrically, and of the unending variety of different types of furnaces or other heating appliances offered him as adapted to these various heating media.

Consideration of fuel oil raises a question as to the suitability of heavy oil or light oil. A choice is made difficult by conflicting claims for dozens of different types of so-called "oil burners" designed for steam, high or low pressure air (or both), and of an equally great variety designed to atomize mechanically.

He is informed that gas is the best fuel and wonders if it should be city gas, natural gas, water gas, oil gas, mixed gas, hot or cold producer gas, or some other form of gas.

When proper study of the problem as a whole discloses the fact that the economic relation of the many different forms of fuel or electricity continually varies with an unending and ever-changing variety of furnace designs, he may conclude that when no one knows, every one has a right to guess. So, he makes his guess, assuming that they are all cheap at any price; that each is better or a great deal worse than the other, and that each has its earnest advocates of the type that made Alabama famous.

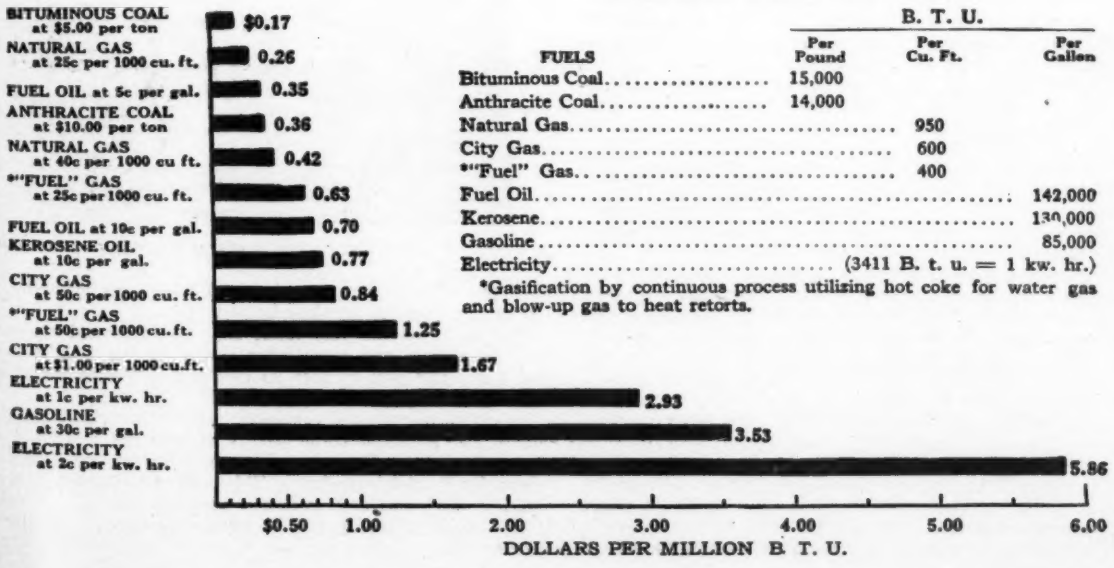
This statement of an undesirable condition is not overdrawn, as it illustrates part of a time-wasting process of more or less useless discussion that is of daily occurrence. It is imperative that a more common-sense perspective of the problem should be cultivated to encourage proper development of the many industrial arts in which heat plays a prominent part; to effectively contribute to the conservation of energy resources; to provide better working conditions for operatives in the shops; and to encourage more constructive thought of the real question at issue, i. e., the quality and over-all cost of the ultimate product or service.

A good move, in the direction of improvement, would be to cultivate the thought that many of the prevailing ideas, and much of the discussion, is really beside the point at issue; that no one form of fuel, food, or medicine is suitable for the general run of requirements; that an attempt to urge the use of any one form of furnace or heating appliance is the equivalent of an attempt to devise one form of dwelling to meet the countrywide requirements of housing, or to provide one form of fuel or equipment for all of the domestic heating operations in that dwelling; that we are more concerned with the practical problem of heat-treatment than with the theoretical condition established by the usual discussions of the so-called "fuel problem," most of which are as interesting and constructive as a debate on the relative merits of wine or water

*By W. S. Rockwell Co., Furnace Engineers, New York.

INDUSTRIAL FUELS

Comparative Cost Per Million B. T. U. at Unit Prices



Assumed Thermal Value

FUELS	B. T. U. Per Pound	B. T. U. Per Cu. Ft.	B. T. U. Per Gallon
Bituminous Coal	15,000		
Anthracite Coal	14,000		
Natural Gas		950	
City Gas		600	
*"Fuel" Gas		400	
Fuel Oil			142,000
Kerosene			130,000
Gasoline			85,000
Electricity	(3411 B. t. u. = 1 kw. hr.)		

*Gasification by continuous process utilizing hot coke for water gas and blow-up gas to heat retorts.

as a beverage, without sufficient thought of the purpose, or occasion, for which the respective fluids may be properly considered.

The technical coloring that has been acquired through years of thought along such lines, lends an air of mystery and complication in the matter of solution, but this is more formidable in appearance than in fact. It is the natural result of a condition whereby the tail of fuel discussion wags the cat of heat-treatment practice. We can well do with less useless discussion about fuels, and more constructive thought of the underlying principles affecting the heating, cooling and handling of products to be heat-treated, and comfort of the operatives, along the common-sense lines followed in the kitchen. There, quality goods are generally delivered in spite of ignorance of the technique of fuel values and the like, which have too long distracted the attention of engineers from the real point at issue.

A perspective of the problem from this angle will pave the way for constructive thought in the matter of selection of fuel, or electricity, and equipment for the factory along the lines that are usually followed in the household, and without the unending and more or less misleading discussion of fuels that effectively retards development of better methods of heating, cooling and handling material, and better working conditions for the operative, which form the basis of a constructive effort to produce better and cheaper products.

It is in order to encourage such view in the interests of the art and all those concerned with the practice of it. Certainly, it suggests the possibility of steering a straight course out of the woods of doubt represented by the mental tangle-foot of conflicting technical opinion, or competitive commercial interest. The journals devoted to fuel oil, city gas, natural gas, coal, electricity, and other forms of heat energy, or equipment or material adapted to them, continually carry matter calculated to convey the impression that the particular form of heat energy to which the publication is devoted is better than any other; and evidence in the form of tests or replacements of one by the other is offered to support such contention. This, on the very face of things, is a ridiculous and illogical condition. It, naturally, develops different schools of thought which, from the standpoint of logic, are on a par with the conflicting political, legal or religious views that mix things up in general.

Improvement is not likely to be effected until it is appreciated that whatever is best for the art as a whole should be good enough for every one connected with it; that those concerned with the selection of fuel, or electricity, and heat-treating equipment, should realize that there is a very big country outside the property lines of their respective plants in which a great deal of development may have been effected, of which they may not have knowledge; that those concerned with the development of different forms of heat energy or equipment should realize that each has its field of usefulness, as well as limitations; that the proper economic relation between any two (at a given time and place) can be most effectively determined by comparison of the nature of the equipment considered with each, and the suitability or "form value" of the combination as a whole to the requirements of the case in hand, along the lines usually followed under similar conditions in the fields of power, transportation and illumination.

Rawleigh Glass Bottle Factory Nears Completion

At Freeport, Illinois, Manufacturer of Flavoring Extracts, Food Products, Toilet Preparations and Prepared Medicine Will Make Own Bottles

Production to Begin in April

The glass bottle factory which was started last summer and is being constructed by the H. L. Dixon Company at Freeport, Ill., for The W. T. Rawleigh Company is now nearing completion. The equipment is being installed and it is expected that production of bottles will begin in April.

A superintendent for the new bottle factory arrived at Freeport and took charge on January 2 and will organize a working force to proceed with the making of bottles when the engineers and contractors turn the factory over to its owners. At the beginning nearly 100 men will be employed.

THE W. T. RAWLEIGH COMPANY

The W. T. Rawleigh Company manufactures household medicines, flavoring extracts, spices, food products and toilet preparations. Its products are sold direct to consumers throughout the United States and Canada. About half of its output of 30 million packages per year is put up in glass containers. Its requirements in bottles are about one carload per day at its factories at Freeport, Memphis, Winnipeg and Montreal.

THE POLICY OF MAKING EVERYTHING

It has long been a policy of The Rawleigh Company to do everything practical within its own organization, and to make practically everything it sells completely in its own factories from raw materials obtained direct from producers in the best primary markets.

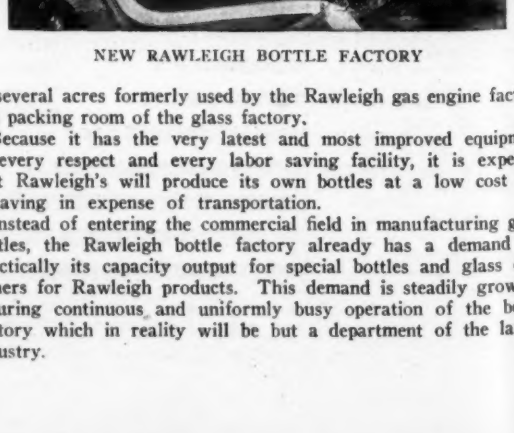
Now in keeping with its policy the Company is going to manufacture glass containers for its products. Practically the entire capacity and output of the bottle factory will be required for Rawleigh products.

MODERN FIREPROOF BUILDINGS

The buildings of the Rawleigh bottle factory are of steel, iron and glass construction with concrete floors and other fireproof features. They cover about 40,000 square feet of floor space or one acre.

The factory will be very complete from the start with engine room, gas producing plant, coal storage and batch plants, where materials may be unloaded from cars into track hoppers by power shovels and elevated by bucket elevators, oil storage, furnace of the most improved type, three bottle forming machines, two lehrs, box factory, packing and shipping room, mold shop and large storage warehouse. Besides having its own engine house, all electrical current for power and light will be carried from the Company's central power house. At the beginning 200 H. P. of electrical energy will be used and more can be supplied as needed.

This bottle factory is in East Freeport on a tract of land



NEW RAWLEIGH BOTTLE FACTORY

of several acres formerly used by the Rawleigh gas engine factory and packing room of the glass factory.

Because it has the very latest and most improved equipment in every respect and every labor saving facility, it is expected that Rawleigh's will produce its own bottles at a low cost and a saving in expense of transportation.

Instead of entering the commercial field in manufacturing glass bottles, the Rawleigh bottle factory already has a demand for practically its capacity output for special bottles and glass containers for Rawleigh products. This demand is steadily growing, assuring continuous and uniformly busy operation of the bottle factory which in reality will be but a department of the larger industry.

The Glass World and What It Is Doing

News of the Industry

Glass Division Will Be Active at Atlanta

All the conditions appear to be favorable for making the twenty-eighth annual meeting of the American Ceramic Society, beginning February 8 at Atlanta, Ga., the largest and most successful ever held by the society.

To the majority of members who live in the northern and central States, a trip to the south is in itself a sufficient attraction to induce the attendance of those able to go, and when the other attractions included in the program are considered, the impulse to attend will doubtless prove irresistible to many.

For the meetings of the Glass Division, of which Alexander Silverman is chairman and A. N. Finn secretary, a fine program has been arranged by J. C. Hostetter, chairman of the program committee, and his aids, F. C. Flint and H. Insley, which includes the following papers:

Glass Division

MONDAY NIGHT 8:00 P. M.

1. "Glass: One of Man's Blessings." Illustrated with lantern slides and specimens. By Alexander Silverman, University of Pittsburgh, Pittsburgh, Pa.
2. Motion Pictures of Glass-Making, Corning Glass Works. By J. C. Hostetter, Corning Glass Works, Central Falls, R. I.

TUESDAY MORNING

3. Glass As a Factor in Civilization. By A. Silverman, University of Pittsburgh, Pittsburgh, Pa.
4. Report of Research Committee—Glass Division. By Dr. E. W. Washburn, Natural Research Council, Washington, D. C.
5. History and Recent Progress in Manufacture of Plate Glass. By J. W. Cruikshank, Pittsburgh, Pa.
6. Comparison of Glass Manufacturing Methods in Various Countries By R. L. Frink, Lancaster, Ohio.

TUESDAY AFTERNOON

7. Fundamental Requirements for Annealing Glass. By A. N. Finn, U. S. Bureau of Standards, Washington, D. C.
8. Some Variations in the Physical Properties of Glass Caused of Heat-treatment. By A. Q. Tool, U. S. Bureau of Standards, Washington, D. C.
9. Some Observations on Determining the Viscosity of Glass. By G. L. Bixby and A. N. Finn, U. S. Bureau of Standards, Washington, D. C.
10. Rate of Founding and Viscosity of Glass as Related to Machine Operation. By R. L. Frink, Lancaster, Ohio.
11. Chemical Composition of Window Glass. By Edwin P. Arthur, O. S. U., Columbus, Ohio.
12. Some Properties of Fused Quartz and Other Forms of Silicon Dioxide. By H. L. Watson, General Electric Co., West Lynn, Mass.

WEDNESDAY MORNING

13. Heat Transfer in Furnaces. By D. J. McSwiney, 1689 W. Third Ave., Columbus, Ohio.
14. Electrically Heated Glass Leers. By A. N. Otis, General Electric Co., Schenectady, N. Y. Discussed by H. L. Read, Con't Tunnel Kiln Corp, New York City.
15. Relative Temperature of Pyrex Glass and Porcelain in Sunlight. By J. T. Littleton, Jr., Corning Glass Works, Corning, N. Y.
16. A Simple Mercury Contact Apparatus for Testing the Breakdown Voltage of Heavy Insulating Materials. By Louis Navias, General Electric Co., Schenectady, N. Y.
17. The Insulating Value of Glass Wool for Refrigeration Purposes. By H. C. Bates, Corning Glass Works, Central Falls, R. I.

WEDNESDAY AFTERNOON

Symposium: Glass Tank Block Corrosion Held Jointly with Refractories Division. Presiding: Dr. Alexander Silverman of the University of Pittsburgh.

18. Some Results of the Tank Block Investigation. By R. F. Geller, U. S. Bureau of Standards, Washington, D. C.
19. The Mullite Content of Some of Our Commercial Blocks. By F. S. Thompson, National Lamp Works of General Electric Co., Nela Park, Cleveland, Ohio.
20. Microscopic Evidence of the Nature of Tank Block Corrosion. By H. Insley, U. S. Bureau of Standards, Washington, D. C.
21. Some Corrosion Tests of Special Refractories. By F. S. Thompson, National Lamp Works of General Electric Co., Nela Park, Cleveland, Ohio.
22. Design of Arches for Kilns and Furnaces. By F. H. Norton, Babcock & Wilcox Co., East Liverpool, Ohio.
23. The Morgue (lantern slides). By Donald Ross, Findlay Clay Pot Co., Washington, Pa.

In the Refractories Division there will also be papers of interest to glass men including "Specifications for Buying Refractories" to be given Tuesday morning by J. Spotts McDowell, of Harbison-Walker Refractories Company, and "Silica Brick from Coke Oven Walls" on Wednesday morning by S. S. Cole, of Mellon Institute; a joint symposium with the Glass Division in the ballroom of the Atlanta-Biltmore Hotel, which is the official headquarters of the annual gathering.

The formal opening of the convention will be at 2 p. m. Monday, February 8, when Governor Clifford Walker, Mayor Walter A. Sims, Charles H. Herty, E. Ward Tillotson, president of the American Ceramic Society, and Ross C. Purdy, secretary; Hon. Frank West, president of the Ceramic Society of England, and A. V. Bleininger will speak.

A banquet will be given on Wednesday evening and other entertainment including special activities for the ladies is arranged for. Side trips to inspect ceramic plants will be made to Macon and other places.

Reduced rates on the one and one-half fare basis certificate plan have been allowed by the railroads.

The Erwin Feldspar Company, through Golding Sons' Company, Trenton, N. J., have invited members returning from Atlanta to visit their mines and mills at Sprucepine, N. C., and Erwin, Tenn.; on the way back, leaving Atlanta on the night of February 12.

The following are the men chosen by members of the nominating committee to serve on the Board of Trustees of the American Ceramic Society for 1926: President, R. L. Clare; vice-president, B. Mifflin Hood; treasurer, H. B. Henderson. For Division Representative: Glass, J. C. Hostetter; white wares, A. V. Bleininger.

Census of Manufactures Under Way

The Bureau of the Census is now engaged in collecting the data for the biennial census of manufacturers, which will cover industrial operations during the calendar year of 1925.

The schedules or questionnaires have already been mailed to all the manufacturers. The success of the census will depend not only on the accuracy of the statistics but on the promptness with which they are published.

The Director of the Census reports that at the census of 1923 it was necessary to send more than 100,000 letters to manufacturers requesting additional information or verification or correction of their reports. This, of course, delayed considerably the publication of the statistics. It is highly important, therefore, to answer each question as accurately as possible and mail reports promptly to the Bureau of the Census at Washington.

Stained Glass Association's European Trip

Plans for the projected European trip for members of the Stained Glass Association of America and their friends have taken definite shape. S. L. Brown, chairman of the committee of arrangements, has prepared an itinerary covering a period from the sailing date from New York on Saturday, May 15, to

Monday, June 28, when the party will arrive back in this country. Sightseeing visits, in some cases by motor, will be made to the following places in England: Southampton, Bristol, Gloucester, Tewkensbury, Malvern, Ludlow, Shrewsbury, York, Oxford and London. On Saturday, June 5, the party will cross the English Channel to Calais and a stop will be made at Amiens before reaching Paris. Visits in France will be made to Bourges, Tours, Porter, Angers, Le Mans, Chartres, then back to Paris. On Saturday, June 19, the party will proceed to Cherbourg and sail for New York.

Plate Glass Production in December

Figures giving the production of polished plate glass in the United States for the month of December, 1925 have been issued by P. A. Hughes, secretary of the Plate Glass Manufacturers of America. The month's output was 9,506,384 sq ft., making the total for the year 117,224,295 sq. ft.

The progress of the industry may be seen in the steady increase in the production of polished plate glass for the past five years:

1921	53,578,682	sq. ft.
1922	76,678,207	sq. ft.
1923	89,069,441	sq. ft.
1924	91,554,474	sq. ft.
1925	117,224,295	sq. ft.

J. D. Biggers Goes to England

J. D. Biggers, vice-president and sales manager of the Owens Bottle Company, Toledo, O., has resigned to become managing-director of the British interests of Dodge Brothers, automobile manufacturers. He sailed for England in January. Mr. Biggers has been connected with the Owens company for twelve years, and prior to that he was for two and one-half years secretary of the Toledo Chamber of Commerce. Mr. Biggers' friends express much regret at his departure from Toledo, but his new position offers such exceptional opportunities that he feels it would not be wise to decline it.

Engineer Takes Up Consulting Work

W. S. Mayers, 234 Watson Avenue, Fairmont, W. Va., who for a number of years has been in charge of mechanical engineering at the Monongah Glass Company during the development and operation of that plant, is entering the consulting field and his services are available as consulting, constructing and designing engineer. Mr. Mayers' long experience in the glass factories has given him a thorough insight into the practical problems of the industry.

His occasional articles, published in THE GLASS INDUSTRY, on mechanical subjects, have attracted much favorable comment.

The Pittsburgh Show

The annual Pittsburgh Exhibit of glassware and pottery continued this year as usual to arouse great interest throughout the trade, acting as a magnet to draw buyers in large numbers from all directions. A large percentage of the glassware manufacturers were represented and staged attractive displays of their products. Colored glassware predominated, its popularity with the buying public evidently increasing as more variety in design and color is provided and greater latitude in price made possible.

A very interesting feature of the exhibition was a completely machine-made goblet manufactured by the Federal Glass Co., Columbus, O., by a new method which has been developed and patented.

Exhibit of Glass from Paris Exposition

A representative selection of objects from the International Exposition of Modern Decorative and Industrial Art which was held in Paris last summer, assembled and brought to this country by Professor Charles R. Richards under the auspices of the American Association of Museums, will be exhibited in the Metropolitan Museum of Art from Monday, February 22, through Sunday, March 21. Among other products the material shown will include glass and pâte de verre by Decorchemont, Dammouse, Marinot, Lalique and Goupy.

Trade Activities

The Pittsburgh Plate Glass Company, at a meeting of the directors held on January 21 at Baltimore, Md., declared an extra dividend of 5 per cent, payable Feburary 1.

The Reflector & Illuminating Company, manufacturers of reflectors, automobile lights, etc., have moved to their new address at 1407-1417 Jackson Boulevard, Chicago, Ill.

The Schram glass factory at Hillsboro, Ill., control of which passed into the hands of Ball Brothers Company, Muncie, Ind., recently, is shut down for necessary repairs and will reopen late in February.

The Chicago Heights Bottle Company, Chicago Heights, Ill., reconstruction of which has been proceeding since the fire which completely destroyed it in September, is nearing completion and bottle manufacturing operations will be resumed before long.

The Blue Diamond Glass Company, Third and Elm streets, Bristow, Okla., has let a contract for a 30 by 60 ft. factory building and are reported by the Manufacturers Record to be in the market for automatic crimping machines, chemicals, sand, boxes, etc.

The McDonald Glass Works, Inc., which recently took over the plant of the Crescent Bottle Company at McDonald, Pa., began operations early in January. The officials of the company are: E. W. Bryce, president; E. A. Bryce, vice-president; Garrett D. Bryce, treasurer, and Emerson Peel, secretary.

Albert Steiner and **George H. Lowe,** Bremen, O., have arranged a partnership and are building a two-pot furnace factory at Bremen for the manufacture of lenses and colored glass products. Mr. Steiner was formerly president of the National Glass & Lens Company, of Lancaster, O.

Illinois Pacific Glass Corporation, San Francisco, Cal., a reorganization of the Illinois Pacific Glass Company, has been granted a Delaware charter. The new corporation is reported as capitalized at $31,000,000, comprising 60,000 shares of class A stock and 250,000 shares of class B stock, all shares to have the same voting power.

The Scohy Sheet Glass Company, Sistersville, W. Va., is reported to be meeting with success in the operation of their new Fourcault equipped sheet glass drawing plant. About 4,000 boxes of glass were said to have been shipped from the factory during the first week of January, and 2,356 sheets, 56 x 62 in., produced in one day of 24 hours.

E. M. Brickell, receiver for the **Ohio Glass Products Company,** Massillon, O., has been authorized by the court to continue operation of the plant until February 13 when a full report is to be made. A loan of $10,000 to finance operations was also authorized. It is reported that Mr. Brickell obtained consent of 72 per cent of the company's creditors to an extension of time.

J. L. Dickson, referee in bankruptcy, of the United States District Court for the Eastern District of Oklahoma, announces that on February 23, 1926, at 2 p. m., H. S. Pilgreen, trustee in bankruptcy, will offer for sale the property of the **LeFlore Glass Company,** of Poteau, Okla., consisting of real estate, buildings, machinery, finished products, cullet, other raw materials and all other property free of liens, subject to the approval of the court. It is reported that the property represents an investment of more than $200,000.

The Eastern Plate and Window Glass Company, Millville, N. J., recently organized with a capital of $150,000, by W. S. Phillips, formerly general manager of the old Van Cleve window glass plant at Brownsville, Pa., are remodeling the old plant of the International Glass Company of Millville with equipment taken from the old Brownsville factory. It is expected that manufacturing operations will begin early in March.

The Phoenix Glass Company, Monaca, Pa., according to a report, has purchased the Monaca Hotel property consisting of a four-story brick building and after making extensive improvements to it the offices of the company at Pittsburgh, Cleveland, Chicago and New York City will be consolidated and headquarters established in the remodeled building. It is said that the lower floor will be used as a display room and the remaining three floors for office purposes. It is also stated that the active officials, including E. P. Eberts, treasurer, and

his entire force now in the Federal Reserve Bank Building at Pittsburgh, will move to the new headquarters.

The Weston Glass Company, Weston, W. Va., at the annual meeting of stockholders, re-elected Louis Wohinc as president and general manager and voted him the sum of $2,000 in appreciation of his work in building up the business to the present high standard. The company is reported to have done over $600,000 worth of business during the past year. Other officers elected were John Weber, vice-president; Godfrey Weber, secretary, and Karl Wohinc, treasurer. A new tank will be put into operation in the factory in March.

Dominion Glass Company, Ltd., who closed down their plant on Delorimier Avenue, Montreal, and moved the equipment to their Wallaceburg, Ontario, factory, began manufacturing operations several weeks ago. A large building has been erected to take care of the selecting and boxing departments, and numerous minor alterations have been made. The plant is under the management of T. W. Bassett, formerly manager of the Montreal plant. The company's annual report for the year ended September 30, 1925, shows a net income of $437,037, after charges, equivalent, after preferred dividend, to $6 a share on the 42,500 shares of common stock outstanding. The balance sheet shows current assets of $3,118,881, and current liabilities $609,933, leaving net working capital of $2,508,948.

Recent Deaths

Henry J. Crowder, formerly president of the General Glass Company, Geneva, N. Y., and also connected with the Powerton Tire Corporation of Rochester, N. Y., is reported to have died at a Palm Beach, Fla., hospital on January 4 as a result of of being battered by the waves against a wooden pier while bathing.

Arthur T. Rowe, connected with the American Window Glass Company at Monongahela City, Pa., died at his home in Creighton, Pa., on January 8. Mr. Rowe had been identified with the window glass business for many years and was the son of Richard Wilson Rowe, one of the pioneer glass manufacturers in Allegheny County.

David Sommers of St. Louis, Mo., formerly president of the Schram Glass Company, Hillsboro, Ill., died suddenly on December 22 while undergoing a surgical operation. Mr. Sommers was very well known and highly regarded by the citizens of St. Louis.

John Hemenway, who for many years was connected with Smith & Hemenway, manufacturers of glass cutters, Irvington, N. J., died suddenly on January 2 of a heart attack.

Personals

J. Louis Van Zelm, vice-president of the Bank of New York & Trust Company, has been elected a director of the Holophane Glass Company.

George G. Muntz, president of Tropenas Company, engineers, 25 Broadway, New York, and who is interested in glass manufacturing in South America, sailed for Brazil on January 30 to visit the company's office in Rio de Janeiro and their new works in that city and Sao Paulo.

George S. Morris, formerly with Gleason-Tiebout Glass Company, New York, on January 1 became associated with H. S. Whiting Co., Inc., manufacturers and distributors of commercial lighting units, with headquarters in the Grand Central Terminal Building. He will devote his entire time to selling in the New York local territory.

A. H. Tischer has joined the engineering force of Foote Bros. Gear & Machine Company of Chicago as designing engineer. Mr. Tischer was connected with the Foote Bros. organization during 1916 and 1917 and left them to join the U. S. Air Service during the war. After the war he became connected with the P. T. Wheel Company of Dayton, Ohio, as designing engineer and later with the Steinmetz Electric Motor Car Corp. as engineer in the tractor division. Since rejoining the Foote Bros. Gear & Machine Company, Mr. Tischer has been engaged in the design of their new line of herringbone speed reducers.

What Our Advertisers Are Doing

The Chapman-Stein Furnace Company, Mt. Vernon, O., reports that the Dominion Glass Company, Ltd., of Canada, has ordered two Chapman-Stein recuperators to be applied to ten-foot revolving pot furnaces. These will be installed at their Point St. Charles factory. This company is already operating four Chapman-Stein recuperators in connection with revolving pots. The Fenton Art Glass Company at Williamsport, W. Va., has contracted for a second Chapman-Stein recuperative day tank. This company installed their first recuperative day tank last May. The last order was for a standard 60" x 100" Chapman-Stein day tank with recuperator. The Owens Bottle Company recently placed two repeat orders covering four Chapman-Stein recuperators for revolving pots at their Fairmont, W. Va., plant. They had previously equipped two of their pots at this plant with similar recuperator. They are also using nine of them at Charleston, one at Clarksburg and four at Glassboro.

Inquiries Received

For Further Information Address: THE GLASS INDUSTRY

311. As I am in the automobile repair business I would like to put in a line of plate glass. Can you give me the names of some manufacturers? (Jan. 6).

312. I wish to get in touch with principal manufacturers of glass door knobs. (Jan. 4).

313. Can you put us in touch with any firm which can manufacture a "three minute" glass tube to contain sand, similar to an hour-glass? (Jan. 7).

314. Can you give me the names of firms who make glass novelties such as vases, vanity sets, etc., which are not fired and which can be used for decorating? (Jan. 16)

315. We would like to have the names of manufacturers of small black glass door knobs. (Jan. 18)

316. Who makes machines for drilling holes in glass?

What the World Wants

Specific inquiries for American goods received in the Department of Commerce

England. 18615, glass jar grinding machines.
Chile. 18622, glassware and porcelain goods; 18711, bottle caps.
Cuba. 18690, glassware and empty bottles.
Denmark. 18732, glass novelties.
Portuguese East Africa. 18749, glassware, earthenware, etc.

Glass Stock Quotations

Reported by Moore, Leonard & Lynch, Union Trust Building, Fittsburgh, Pa.

PITTSBURGH STOCK EXCHANGE, JANUARY 23, 1926.

	Bid	Ask	Last
American Window Glass Machine, com	78	80	79
American Window Glass Machine, pfd	..	91	91
American Window Glass, pfd	106	109	108
United States Glass	18¾	19	18¾
Pittsburgh Plate Glass	296	300	300
Standard Plate Glass, com	6⅝	6¼	6¼
Standard Plate Glass:			
Preferred cumulative	20½	52	32
Prior	77	80	80⅛

Glass stocks on the Pittsburgh Stock Exchange were unchanged from the ruling prices last month. Little activity was noted, with reports on production holding the ground reached in 1925. Several specialty firms are conducting January shows of their complete line of products.

WHEELING STOCK EXCHANGE, JANUARY 23, 1926.

	Bid	Ask	Last
Hazel-Atlas	..	..	42
Imperial	..	..	72
Fostoria	..	..	150
Central	..	..	75

TOLEDO STOCK EXCHANGE, JANUARY, 1926.

	Bid	Ask	Last
Owens Bottle Machine, com	..	..	63⅛
Libbey-Owens Sheet Glass, com	..	..	177¼
Libbey-Owens Sheet Glass, pfd	..	..	114

Current Prices of Glass-Making Materials

Quotations furnished by various producers, manufacturers and dealers.

January 23, 1926

		Carlots	Less Carlots
Acid:			
Citric	lb.	.45	.45
Hydrochloric (HCl) 20° carb. ext. per 100	lb.	.90	1.00
Hydrofluoric (HF) 60% (lead carb.)	lb.	..	.13½
52% and 48%	lb.		.10-.11½
Nitric (HNO_3) 38° carboy ext. Per 100 lb.		5.25	5.50
Sulphuric (H_2SO_4) 66°	ton	14.00	15.00
Tartaric	lb.	..	.29
Alcohol, denatured	gal.	.42	.60½
Aluminum hydrate ($Al(OH)_3$)	lb.	.05	.05½
Aluminum oxide (Al_2O_3)	lb.	..	
Ammonium fluoride (NH_4F)	lb.	..	.23
Ammonia water (NH_4OH) 26° drums	lb.	..	.04
Antimony, metallic (Sb)	lb.	..	.22½
Antimony oxide (Sb_2O_3)	lb.	..	.19-.21
Antimony sulphide (Sb_2S_3)	lb.	..	.20
Arsenic trioxide (As_2O_3) (dense white), 99%	lb.	03½	.04
Barium carbonate ($BaCO_3$)			
Precipitated	ton	44.00-50.00	47.00-54.00
Natural powdered	ton	42.00-44.00	45.00-46.00
Natural, powdered, imported	ton	38.00	40.00
Barium hydrate ($Ba(OH)_2$)	lb.	..	.05
Barium nitrate ($Ba(NO_3)_2$)	lb.	.07¼	.08
Barium selenite ($BaSeO_3$)	lb.	..	..
Bone ash	lb.	.05½	.06½
Borax ($Na_2B_4O_7 10H_2O$)	lb.	.04¾	.05-.05½
Boric acid (H_3BO_3)	lb.	.09	.09¾
Refined	lb.	.10	.10½
Cadmium sulphide (CdS)—			
Red	lb.	..	1.25
Orange	lb.	..	1.10-1.25
Yellow	lb.	..	..
Chromium oxide (Cr_2O_3)	lb.	.30	.31-.32
Cobalt oxide (Co_2O_3)			
In bbls.	lb.	..	2.10
In 10 lb. tins	lb.	..	2.20
Copper oxide			
Red (Cu_2O)	lb.	.	.30
Black (CuO)	lb.	..	.25
Black prepared	lb.	..	.30
Cryolite ($Na_3Al F_6$)	lb.	..	.09¼
Epsom salts ($MgSO_4$) (imported) Per 100 lb.		..	1.30
Feldspar—			
100 mesh	ton	12.00-20.00	16.00-22.00
80 mesh	ton	..	..
40 mesh	ton	..	..
Fluorspar (CaF_2)—			
Powdered white, 95%	ton	40.00	..
" " 90%	ton	38.00	..
Formaldehyde	lb.	.09	.09½
Graphite (C)	lb.	..	.04-.07
Iron oxide—			
Red (Fe_2O_3)	lb.	..	.02
Black (FeO)	lb.	..	..
Kaolin (f.o.b. mine)	ton	10.00	..
English, lump, f.o.b. New York	ton	13.00-23.00	..
Lead chromate ($PbCrO_4$)	lb.	..	..
Lead oxide (Pb_3O_4) (red lead)	lb	.12¼	.12½
Litharge (PbO)	lb.	.11¾	.12
Lime—			
Hydrated ($Ca(OH)_2$) (in paper sacks)	ton	12.50	..
Burnt (CaO) ground, in bulk	ton	9.00	..
Burnt, ground, in paper sacks	ton	11.00	..
Burnt, ground, in 280 lb. bbls. Per bbl.		2.15	2.30
Limestone ($CaCO_3$)	lb.	..	..
Magnesia (MgO)—			
Calcined, heavy	lb.	.04½	.05
Light	lb.	.22	.24
Magnesium carbonate ($MgCO_3$)	lb.	.06¼	.06¾
Manganese 85% (MnO_2)	lb.	.05	.05½
Nickel oxide (Ni_2O_3), black— for nickel content	lb.	..	.35
Nickel monoxide (NiO), green— for nickel content	lb.	..	.35
Plaster of Paris, bags	ton	..	19.00
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb.	.08½	.08¾-.10
Ground	lb.	.11	.12
Potassium carbonate—			
Calcined (K_2CO_3) 96-98%	lb.	.06½	.06¾
Hydrated 80-85%	lb.	.05¾	.06
Potassium chromate (K_2CrO_4)	lb.	..	.27
Potassium hydrate (KOH) (caustic potash)	lb.	.07⅛	.07⅝
Potassium nitrate (KNO_3) (gran.)	lb.	.06¼	.06⅝
Potassium permanganate ($KMnO_4$)	lb.	.14½	.15¼
Powdered blue	lb	..	.24-.26
Rochelle salts, bbls.	lb.	..	.20
Rouge	lb	..	..
Rutile (TiO_2) powdered, 95%	lb.	.20	.25
Salt cake, glassmakers (Na_2SO_4)	ton	20.00-22.00	23.00
Selenium (Se)	lb.	..	2.10-2.15
Silver nitrate ($AgNO_3$)	oz.	..	.47½
Soda ash (Na_2CO_3) dense, 58%—			
Bulk Flat per 100 lb.		1.35-1.40	..
Bulk, on contract Flat per 100 lb.		1.35	..
In barrels Per 100 lb.		1.69	2.40
In bags Per 100 lb.		1.45	..
Spot orders .05 per 100 lbs higher			
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.06½	.06¾
Sodium hydrate (NaOH) (caustic soda) Per 100 lb.		3.10	3.76
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	lb.	.03⅞	.04⅛
95 per cent. Per 100 lb.		2.69	2.80
Sodium selenite (Na_2SeO_3)	lb.	..	2.35
Sodium fluosilicate (Na_2SiF_6)	lb.	.04½	.05
Sodium uranate (Na_2UO_4)	lb.	..	1.15
Sulphur (S)—			
Flowers, in bbls. Per 100 lb.		3.35	3.65-3.90
Flowers, in bags Per 100 lb.		3.00	3.30-3.55
Flour, heavy, in bbls. Per 100 lb.		2.65	2.95-3.20
Tin chloride ($SnCl_2$)) (crystals)	lb.	..	.43
Tin oxide (SnO_2) in bbls.	lb.	..	.66
Uranium oxide (UO_2), 100 lb. lots	lb	..	..
Zinc oxide (ZnO)	lb.	.07½	.07¾

Monthly Summary of United States Foreign Commerce in Glass

EXPORTS

Corrected to December 24, 1925

	November 1924 Quantity	November 1924 Value	November 1925 Quantity	November 1925 Value	Eleven Months Ending November 1924 Quantity	Eleven Months Ending November 1924 Value	Eleven Months Ending November 1925 Quantity	Eleven Months Ending November 1925 Value
Glass and glass products (total)	.....	759,920	.....	699,859	.....	8,089,847	.....	7,910,143
Plate and window glass—								
Window glass, common, box 50 sq. ft.	7,729	29,845	2,368	10,329	38,980	175,304	23,900	135,502
Plate glass, unsilvered, sq. ft.	158,884	38,672	201,337	45,542	1,603,944	475,108	1,383,971	367,340
Other window and plate glass, n.e.s. lbs.	112,301	12,186	152,751	19,195	1,906,596	202,762	2,261,766	254,941
Glass containers (bottles, vials and jars) lbs.	5,021,418	236,730	4,119,479	190,258	56,075,668	2,662,266	56,989,853	2,614,395
Table glassware, plain lbs.	1,281,750	139,858	1,367,049	127,423	15,256,556	1,639,919	15,701,207	1,586,100
Table & other glassware, cut or engraved. lbs.	73,995	20,994	76,593	17,618	511,437	155,219	596,583	149,418
Glassware for lighting—								
Lamp chimneys and lantern globes .. lbs.	158,091	27,019	121,661	25,196	1,766,987	327,409	1,698,492	316,712
Globes and shades for lighting fixtures lbs.	181,706	41,368	130,484	37,834	1,276,631	369,057	1,490,597	448,066
Lamps and other illuminating devices, chiefly of glass lbs.	101,784	41,033	70,706	17,424	938,120	280,983	786,339	202,256
Chemical glassware lbs.	20,622	16,104	16,754	15,062	222,267	178,863	207,676	176,339
Electrical glassware, except for lighting lbs.	173,124	24,589	73,591	13,253	2,315,326	232,397	2,505,283	252,511
Other glassware, n.e.s. lbs	508,458	131,522	942,331	180,725	7,910,847	1,390,560	7,616,421	1,406,568

IMPORTS

Corrected to December 24, 1925

Glass (total)	.....	1,368,304	.....	1,531,989	.....	17,995,976	.....	16,137,486
Cylinder, crown and sheet—								
Unpolished, lbs. dut.	1,873,985	114,773	3,648,484	191,800	28,434,337	1,633,435	42,897,008	2,242,446
Bent, ground, beveled, colored, painted, etc., and polished dut.	.....	60.231	.....	41,319	.....	477,398	.....	488,398
Plate Glass—								
Unsilvered, sq. ft. dut.	1,025,769	512,862	1,286,206	433,310	15,834,283	9,461,823	14,630,527	6,617,801
Fluted, rolled, etc., or silvered, or containing wire netting, sq. ft. dut.	111,181	20,375	179,159	24,725	2,386,618	333,699	1,221,798	190,035
Containers—bottles, vials, etc. dut.	.....	15,896	.....	20,798	.....	192,768	.....	168,161
Table and kitchen utensils, lbs. dut.	94,331	28,792	55,652	17,603	841,771	195,294	550,256	134,255
Glassware, cut or decorated, lbs. dut.	363,696	192,358	424,512	256,835	3,697,620	1,761,441	3,861,621	2,142,513
Blown glassware, n.e.s.—								
Bottles, ornaments, etc., lbs. dut.	899,848	219,841	1,065,708	281,165	6,180,685	1,771,810	5,255,191	1,575,047
Bulbs or electric lamps, number dut.	1,758,240	18,259	516,393	7,134	13,960,343	186,480	15,702,000	162,941
Chimneys, globes, shades, etc., lbs. dut.	288,387	90,347	397,666	85,210	4,189,318	821,981	4,532,363	984,597
Articles and utensils for chemical, scientific, experimental purposes lbs.	76,714	20,614	76,261	41,587	916,703	310,478	870,980	337,648
Other glassware dut.	.....	73,956	.....	130,503	.....	849,369	.....	1,093,639